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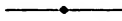
Presented by

New Jersey Custodian

1916



LEGISLATIVE
DOCUMENTS



Vol. VI.

DOCUMENTS
OF THE
ONE HUNDRED AND FORTY-FIRST
Legislature
OF THE
State of New Jersey
AND THE
SEVENTY-THIRD
Under the New Constitution

VOL. VI.

Documents 38 to 52 Inclusive

TRENTON, N. J.
STATE GAZETTE PUBLISHING CO., PRINTERS
1917

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- No. 39. REPORT OF THE BOARD OF SHELL FISHERIES, FOR THE YEAR ENDING OCTOBER 31ST, 1916, EMBRACING THE ANNUAL REPORTS OF THE BOARD OF SHELL FISHERIES, COMPRISING THE DEPARTMENT OF THE MAURICE RIVER COVE AND THE DEPARTMENT OF THE ATLANTIC COAST.
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Document No. 38

Annual Report

OF THE

Board of Fish and Game
Commissioners

FOR THE

Year ending October 31st, 1916

ANNUAL REPORT

OF THE

Board of Fish and Game Commissioners

FOR THE

Year Ending October 31, 1916



New Jersey Reformatory Press
Rahway, N. J.

LIST OF FISH AND GAME COMMISSIONERS

Holding Office at the Date of This Report

ERNEST NAPIER, <i>President</i> ,.....	East Orange, N. J.
WILLIAM A. LOGUE, <i>Treasurer</i> ,.....	Bridgeton, N. J.
WILLIAM A. FAUNCE,.....	Atlantic City, N. J.
BERNARD M. SHANLEY, JR.,.....	Newark, N. J.

WALTER H. FELL, *Secretary*,

Office of the Board, State House, Trenton, N. J.

List of Fish and Game Wardens Holding Commissions at the Date of this Report

STRATTON, JAMES M., <i>Protector</i> ,.....	North Long Branch
MATHIS, HOWARD, <i>Assistant Protector</i> ,.....	New Gretna
CUDNEY, HARRY E., <i>Assistant Protector</i> ,.....	Hackettstown

AVIS, JOHN H.,.....	Woodbury
BAILEY, JOHN B.,*.....	Washington
CONNER, FRED S.,.....	Bridgeton
COX, JOHN F.,*.....	Washington
EVERNHAM, JAMES H.,.....	Bayville
FOLKER, CHARLES W.,.....	Camden
HALL, FRED J.,.....	Bloomfield
HILLIARD, PHINEAS K.,.....	Manahawkin
HOBLITZELL, WILLIAM,.....	Rahway
KLEIN, WILLIAM C.,.....	Clifton
LODER, WILLIAM B.,.....	Egg Harbor City
LOVELESS, HARRY M.,.....	Trenton
MORTON, CHARLES C.,.....	Mount Holly
PARK, JOHN J.,.....	White House Station
PHIFER, GEORGE W.,.....	Ormond
RIDER, ANSON J.,.....	Tuckerton
ROE, JACOB D.,.....	Newton
SMALL, OTIS C.,.....	Hammonton
SMALL, WILLIAM HENRY,.....	Englewood
STEEL, WILLIAM,.....	Cape May Court House
STEUERWALD, CHARLES,.....	South Amboy
THOMPSON, DAVID A., JR.,.....	Salem
THORNE, GARRET P.,.....	Holmdel, P. O. Matawan
WELSH, CHARLES E.,.....	East Millstone
WHITE, HARRY W. D.,.....	Pennsville
YOUNG, WILLIAM E.,.....	Chester

* Temporary.

LETTER OF TRANSMITTAL.

To His Excellency, James F. Fielder, Governor, and to the Members of the Senate and General Assembly of the State of New Jersey:

As required by law, we submit herewith the annual report of the work of the Board of Fish and Game Commissioners for the year ending October 31st, 1916.

Very respectfully,

ERNEST NAPIER,
WILLIAM A. LOGUE,
W. A. FAUNCE,
B. M. SHANLEY, Jr.,
Commissioners.

ANNUAL REPORT

Supported solely by proceeds derived from those who hunt and fish in this State, the Board has closed the most successful year of its existence. In no feature of our work was there a step backward, nor did we stand still in any particular. All our activities were broadened and intensified. Proof of all this we confidently believe may be found in the satisfaction expressed by our citizens who are familiar with our administration. We call particular attention to the year's results at our Fish Hatchery and Game Farm, and to our investigation of the shad industry which are detailed in the pages following.

It is becoming better understood that our Board has no authority to review judicial proceedings in fish and game cases. However, appeals are often made to us to remit a penalty where the defendant pleads extreme poverty and even in cases where defendants are possessed of considerable worldly goods. Any failure to administer our law places a premium upon violations, works an injustice to all law-abiding sportsmen and permits the destruction of the natural resources of the State. It has been well said that a person who is prosperous enough to be possessed of a gun and ammunition and takes time to hunt is prosperous enough to pay a penalty for wilful failure to obey the law. If poverty of a defendant were allowed as an excuse a wholesale slaughter of our birds and fish would follow. The true sportsman knows that in the conservation of the remnant of our game and fish lies the opportunity for future pursuit of the same. The members of our Board take an oath to enforce the laws, and the Commissioners take more joy in the thousands of

hunters and fishermen enjoying themselves legally than contemplating one violator penalized or in jail.

U. S. Federal Migratory Law.—August 21st President Woodrow Wilson approved amended regulations of the U. S. Department of Agriculture respecting the seasons for migratory birds, which were intended to meet criticisms on seasons already fixed by the Federal authorities.

Considerable criticism is still directed against the Federal seasons, especially in the matter of ducks and shore birds. As to the duck season, fixed from October first to January fifteenth, it is claimed that the season commences too early and closes too soon. As to shore birds, it is claimed that the season should commence August first instead of August fifteenth.

Respecting the expectation of many persons that the U. S. Supreme Court would declare the Federal law unconstitutional, it should be noted that during 1916 the U. S. Senate ratified a treaty between the United States and Canada for the protection of migratory wild birds. Friends of the treaty take the position that under the United States Constitution and other authority all treaties made shall be the supreme law of the land and the judges in every State shall be bound thereby. The agreements in the present treaty are practically identical with the regulations made under the Federal Migratory Bird Law, and it is stated by William S. Haskell, Counsel for the American Game Protective Association, that the treaty makes it unnecessary to bring the case now pending in the U. S. Supreme Court to argument.

In any reading of the U. S. bulletins on seasons, it must be remembered that a ruling of the Federal authorities is that a date fixed by a State governs the season when the date opens the season later or closes it earlier than the announced Federal seasons.

Game Refuge.—The Board executed on the third day of October, 1915, an agreement with the Rossiter Realty Company for the leasing for one dollar for five years, five thousand acres of forest land, known as Buckwood Park, located in Knowlton, Blairstown and Pahaquarry Townships, Warren County, for the purpose of a game refuge. The following clause is taken from the agreement:

"It is understood and agreed by and between the parties hereto that no game shall be killed on the said leased premises by the party of the first part or any one claiming under it, or by the party of the second part or their agents or servants."

The State has the right to trap on the preserve such game animals or game birds as in their judgment shall seem advisable. It was made a part of the agreement that the Rossiter Realty Company should at its own expense surround the refuge by at least one wire on the boundary thereof. Charles C. Worthington, who originally established the preserve for his private use, says that the preserve contains more deer running at large than any other tract of the same acreage in the country, and nowhere in the United States can wild deer be seen as invariably and in such numbers by the casual visitors.

It is believed that by the protection afforded in this extensive refuge all sorts of game inhabiting the land will multiply rapidly and spread to the surrounding country. The Board took adequate measures to protect the refuge during the deer season, and the general open season. The Board posted the land and had circulars printed showing the act of the Legislature giving it authority to acquire land for game refuges. The idea of a game refuge is not regarded any longer as an experiment by expert conservationists, and in taking over this land by lease the State has followed in the steps of the Federal authorities, who maintain extensive refuges in several parts of the United States.

Receipts, Fines, etc.—The amount received by the State Treasurer during the year on account of the Hunters' and Anglers' License Act of April 9, 1914, was \$101,947.05.

By reason of the repeal of the Resident License law, a balance remaining in that account, \$1,096.74, was transferred in October to the Hunters' and Anglers' License Fund.

The aggregate of fines collected for violations of the fish and game laws amounted for the year to \$6,330.11.

For licenses to steamers and sailing vessels to take menhaden with purse nets within the three-mile limit of our coast there was received \$5,325, as compared with \$6,300 for last year. The decrease can be accounted for on account of the scarcity of menhaden. At the date of this report there are 22 steamers and 22 sailing vessels holding licenses to take menhaden. The fees for steamers range from \$100 to \$200, according to tonnage, while the flat rate for sailing vessels is \$25. The licenses are for the calendar year.

On account of licenses for the operation of fish pounds in the Atlantic Ocean and Sandy Hook Bay the receipts during the fiscal year were \$5,510. For the calendar year for which licenses were issued there were 143 licenses granted, 102 for the Atlantic Ocean, and 41 for the above mentioned Bay.

Following is a summary of the reports of pound fisheries for the year ending December 31, 1915:

Approximate value of all pounds.....	\$471,217.34
Proceeds derived from sale of fish.....	617,326.88
Number of pounds of fish caught and disposed of....	26,394,479
Licenses issued—	
Atlantic Ocean	102
Sandy Hook and Raritan Bays.....	45
	<hr/>
	147
Number of pounds operated.....	146
Number of men employed.....	795

For the period between the close of the quail season in 1915 and March 31, 1916, 1,483 permits were issued to hunt foxes.

Under the law which allows a citizen above the age of 10 years and below the age of 14 years to hunt when provided with a special license, and accompanied by a holder of a regular license above the age of 21 years, 29 licenses were issued from November 1, 1915, to October 31, 1916.

Prosecutions.—During the year ending October 31st there were 392 prosecutions; 369 of the defendants were convicted; 14 were acquitted, 6 cases were abandoned, either on advice of the Attorney General as to the law, or for lack of evidence in possession of the person making the complaint to the Warden; 3 cases are still pending; 20 cases were appealed to the Common Pleas Court. In default of payment, 17 of the defendants were committed to the county jail for periods of 10 to 90 days. In 12 cases, by reason of age or circumstances, sentence was suspended on payment of costs. The licenses of four hunters were revoked, and 34 guns were confiscated from aliens, each of whom was not the owner of real estate to the value of \$2,000.

The number of prosecutions during the past year was 43 less than last year, when 435 persons were arrested. As the wardens have been active, we can only attribute this falling off to the fact that the laws were better observed.

Publicity.—The Board has resumed publication of a "News Letter," which is sent approximately each month to the newspapers of the State and to the newspapers of New York and Pennsylvania which circulate largely in New Jersey. This publicity work has been found to be of great value in creating a better understanding of our laws and work, not only by hunters and fishermen, but by all classes. To indicate the character of the matter in the news letters there follow some topics of articles which have been printed:

"Wood Ducks Plentiful But Still Protected."
 "Fortunes In Furs on New Jersey Lowlands."
 "Old Time Coon Hunts Again Popular Sport."
 "Defend Red Drum Fish as Jersey Coast Asset."
 "Laws Save Pheasants Once Thought Extinct."
 "Health Authorities Join War on Cats."
 "Shad from West May Revive Eastern Runs."
 "Hunt Vagrant Cat as Wolf, Says Scientist."
 "Disarming of Aliens Saves Birds and Game."
 "Lobster Fisheries on Jersey Coast Increase."
 "Federal Law Restores the Crop-Saving Birds."
 "New Jersey Gets a Great Game Preserve."

The newspapers within and without the State have eagerly seized upon these articles and have given them places of prominence in their columns.

The public were further acquainted with the work of the Board by the distribution of 15,000 fish and game law books, 15,000 charts on paper known as emergency charts showing the seasons, 40,000 small English charts on cardboard, 2,000 large English charts on cardboard, 2,000 small Hungarian charts and 2,000 small Italian charts on cardboard. There were also printed 1,500 copies of the Annual Report of the Board, the hunting and fishing licenses and various forms for office use.

Distribution of Fish.—Protector James M. Stratton reports a total of various species of fish planted in the lakes and streams of the State during the fiscal year ending October 31, 1916, as 39,022,587. The source of supply is shown in the following tabulation:

TOTAL FROM HATCHERY—

Rainbow Trout	218,395	
Brook Trout	261,205	
Land-locked Salmon	11,800	
Brook Trout Fry	12,000	
Perch	38,250,000	
Chinook Salmon	132,900	
Black Bass	5,000	
		<hr/> 38,891,300

TOTAL FROM U. S. BUREAU OF FISHERIES—

Brook Trout	200	
Perch	400	
Black Bass	800	
Crappie	800	
		<hr/> 2,200

FISH AND GAME COMMISSION,

TOTAL FROM ORANGE, BOONTON, OAK RIDGE AND
CLINTON RESERVOIRS, DELAWARE AND RARITAN
CANAL, AND OTHER PRIVATE WATERS—

Baitfish	38,469	
Black Bass Fry.....	18,000	
Rock Bass	831	
Perch	50,988	
Black Bass	9,735	
Crappie	1,000	
Pickere!	8,564	
Catfish	1,500	
		129,087
		<u>39,022,587</u>

On January 3rd we commenced netting a portion of the Delaware and Raritan Canal for black bass and other fish for stocking purposes. The bass taken in January were from six inches in length to four pounds in weight, and the pickerel, perch and crappie also averaged a good size. All the fish taken from the canal were planted in lakes in the counties in the middle and southern sections of the State.

The Board also secured a large supply of good-sized fish in netting the Orange, Boonton, Oak Ridge, Clinton Reservoirs and other private waters.

The Princeton Fish and Game Association, under a permit issued by the Board, during the suspension of navigation in the Delaware and Raritan Canal, at their own expense, caught 704 black bass, which were placed in Carnegie Lake at Princeton.

Hatchery.—Three bass ponds were completed at the Hatchery, at a cost of \$3,069, by J. W. Heller of South Orange, who was the lowest bidder for the work. The raising of black bass in captivity is a difficult matter, but the Board believes that we can make a success of it, and if this is done a notable step forward will be taken in the stocking of our waters. The demand for bass raised in the private hatcheries greatly exceeds the supply, and it is practically impossible to purchase bass of a suitable size for stocking. For many years our supply of bass came principally from the Delaware and Raritan Canal, and for the past three years we have secured a number from various reservoirs in the State.

During the spring and summer we had in our employ a person experienced in the taking of fish eggs and small bass from lakes and streams, which were removed to the Hatchery to be raised to a suitable size for stocking.

Superintendent Charles O. Hayford, of the Hatchery, in his fourth annual report says:

"The practical propagation of food and game fishes by artificial means is now conceded to be not only a success, but one of the greatest triumphs of modern science. When I say modern I do not forget that fish culture is an old science; it goes back to an early date in the history of China, and its origin is lost in antiquity. In 1763 Stephen L. Jacobi, a Prussian soldier, devised a process of stripping the female fish of her spawn and then mixing it with the milt of the male. This simple method is still in use at all fish hatching establishments. About fifty years after Jacobi's work, Joseph Remy, a fisherman of the Vosges Mountains, made a discovery upon which the entire business of economic fish culture or to-day practically rests. This discovery was that impregnation of fish eggs takes place after they have left the body of the animal, and can therefore be performed as well by artificial means as in the natural way by the fish themselves, with the exception of the bass family.

"About forty years after Remy's discovery the first government fish culture station was established at Huningen, in Alsac, Hungary, and during the following year one was established on the river Tay in Great Britain. In 1865, Dr. Theodore Garlic, of New Hampshire, imported salmon eggs from Canada and hatched them in a trout pond at Cold Springs, N. H. The interest in fish culture rapidly advanced, and in 1871 our government established a national fish commission.

"The work since that time has been taken up by most of the states, a great many clubs, and private companies. It should not be denied that a great many phases of the work are still in an experimental stage, as the various kinds of fish require different methods of handling and hatching of eggs. The essential fact is positive, i. e., that artificial propagation of fish is necessary if the future generations are to receive a cheap and healthy food, and the angler is to continue to exist.

"Although New Jersey was one of the last to take up this work, it now has one of the largest, most modern and best equipped plants in the United States.

"On November 13, 1915, we received 500,000 Royal Chinook salmon eggs from the Fish and Game Commission of the State of Oregon. These eggs were hatched with very good success and grew to seven and eight inches in nine months. We have the same number of Chinook salmon eggs bought for next year.

"From our brown trout brood fish we stripped 200,000 eggs. These were hatched successfully and are now three and four inches long. As we could not buy brown trout eggs, it was necessary for us to raise our own breeders. I believe it best to follow the course of New York, Michigan, Wisconsin and Pennsylvania in stocking

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suitable streams with brown trout, as he is a game fighter and reaches a weight of eight to fifteen pounds and rises readily to fly in a great many sections. I do not advise stocking natural brook trout streams with brown trout.

"In April we collected 34,000,000 yellow perch eggs from lakes in the northern section of the State, and hatched them in our new batteries, besides hatching 10,000,000 received from the U. S. Bureau of Fisheries.

"On June 10th to 18th, I visited six of the hatcheries of Michigan and Wisconsin to learn and discuss their methods of fish culture. The bass hatchery at Comstock Park, Michigan, in charge of Dwight Lydell, Assistant Superintendent of Michigan Commission, I found very instructive and gathered much valuable information. Mr. Lydell is the most successful bass culturist in the United States, and kindly gave me his entire time for three days showing and explaining his methods. Mr. Seymour Bower, Superintendent of the Michigan Commission, has visited our Hatchery, and he says he can see no reason why we should not be able to raise small mouthed bass, as our conditions are similar to theirs.

"In June we collected 15,000 small mouthed black bass fry, $\frac{1}{2}$ inch long, 1 week old, from lakes in the northern section of the State and transferred them to a small lake at the Hatchery for rearing. The result was beyond all expectations. September 15th and 16th we collected 5,620 as fine bass as could be desired, three to four inches long. We now have five ponds completed and available for bass work. Next year we hope to place from 30,000 to 50,000 bass fry in ponds as ponds can be made to produce feed for that amount. The small mouthed bass is one of the most highly prized fish which inhabits our inland waters and one of the species the anglers seek most during the summer months.

"I would recommend that the Department build bass ponds as fast as funds are available in order that it may stock liberally ponds and lakes in the northern section of the State with small mouthed bass and southern sections of the State with large mouthed bass and pickerel.

"We gave an aquarium exhibit at the Inter-State Fair, at Trenton, for the first time this year, of the following food and game fishes of the State: brook trout, rainbow trout, land-locked salmon, chinook salmon, small and large mouthed black bass, pickerel, perch, sun fish, rock bass and catfish. The exhibit, consisting of nine tanks, attracted a great deal of attention and was very educational. A great many persons were not aware of the fact that the State had a Fish Hatchery.

"The improvements completed and purchased during the year are as follows: Built three large bass ponds, 170 feet long, 70 feet

wide, 1 to 6 feet deep; graded 3,000 lineal feet of roadbed, 7½ feet wide, filled in same with eight inches of broken slate, rolled the slate down to four inches in thickness, and it is now ready for fine screenings of crushed stone; graded 800 lineal feet of walks, four feet wide, filled same with six inches of broken slate, rolled slate to three inches, and it is ready for fine screenings of crushed stone; filled and graded 1,800 lineal feet of bank, 12 feet wide; set out 1,287 lineal feet of same with shrubbery; filled and graded lower side of entrance road, 970 feet long, 50 feet wide, set out same with shrubbery; excavated trench 1,030 lineal feet long, 5½ feet wide, 2 feet deep, filled same with stone for foundation for retaining wall and concrete water course; built on above foundation 970 lineal feet of retaining wall, 2½ feet high, 18 to 12 inches thick; laid 3,100 square feet of concrete water course, 5 inches thick; unloaded and carted one carload of manure from station; carted and spread 300 bushels burnt lime on corn field; built addition to barn 26 feet by 30 feet; purchased one large gray horse six years old, weight 1,300 pounds; purchased new Ford car for general use around Hatchery and in collecting eggs and fish from lakes in the State.

"Bought one roller, one scraper, and one harrow; planted seven acres of corn, harvested 625 bushels; harvested 10 tons of hay; harvested 200 tons of ice; strung wire from Hatchery to lodge house to furnish lights at house and gates; built 1,093 feet of Knox fence seven feet high, three strands of barb wire on top; installed pump in storage building for pumping water into tanks when distributing fish; laid 200 feet of two-inch pipe to and from same; installed five light lamp posts on loading platform for light when loading fish or working around Hatchery at night; built 200 jar battery for hatching perch; built 1,506 feet Knox fence five feet high on both sides of entrance road, painted posts and braces with two coats of paint; graded and filled in around Hatchery building and ponds; put leaders and gutters on Assistant Superintendent's house; painted 100 hatching troughs in hatching buildings and nursery.

"The following are under construction or about to be constructed: top finish of 3,000 feet of road, 7½ feet wide; top finish of 800 feet of walks, four feet wide; 1,000 feet of walk, four feet wide, to be graded and built; 1,400 feet of road, average 8½ feet wide, to be graded and built; one large bass pond, 250 feet long, 150 feet wide, partially excavated and under construction: 400 feet of trench, 400 feet of 2-inch pipe laid in same to carry water from spring near Bell's line to new bass pond; trench four feet deep, 150 feet long for 150 feet of 12-inch drain pipe.

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"The following varieties of fish were raised and planted:

	Raised from Nov. 1, 1915, to Oct. 31, 1916	Estimated No. on hand Nov. 1, 1916
Fingerling rainbow trout, 2 to 7 in. long.....	474,000	400,000
Yearling rainbow trout, 6 to 8 in. long.....	278,935	124,500
Two-year-old rainbow trout, 9 to 12 in. long.....	28,000	10,000
Fingerling brook trout, 3 to 6 in. long.....	334,990	25,000
Yearling brook trout, 7 to 10 in. long.....	16,886	1,200
Two-year-old brook trout, 10 to 12 in. long.....	3,599	500
Fingerling brown trout, 3 to 4 in. long.....	100,000	100,000
Yearling brown trout, 6 to 8 in. long.....	1,500	1,500
Three-year-old brown trout, 14 to 18 in. long..	1,450	1,250
Three-year-old steelhead trout, 14 to 18 in. long	1,000	800
Fingerling chinook salmon, 5 to 9 in. long.....	152,010	3,000
Fingerling landlocked salmon, 1 to 2 in. long..	10,000	.....
Yearling landlocked salmon, 3 to 5 in. long.....	15,853	.....
Small-mouthed black bass, 3 to 4 in. long.....	5,620	500
Yellow perch fry.....	41,000,000	.....
Totals	42,423,843	668,250

Game Stocking, Deer Killed, etc.—The Board directed Protector Stratton to ascertain the approximate number of Hungarian partridges in the State, and the reports received indicate that there were last January about 490 birds, 430 of which were in four counties, namely, Salem, Somerset, Hunterdon and Gloucester. Our last distribution of this bird was in 1912. In other parts of the State where partridges had been liberated they were seen for the first and second years, but have now practically disappeared. We never had any reports of many of the partridges being killed. In this connection, however, it is interesting to know that the English Setter Club, of Medford, N. J., generally liberate about 100 of these birds each year for their field trials, and claim that the bird is fairly becoming established in the vicinity. The counties in which birds were reported are the following:

Atlantic	1	covey	12	birds
Burlington	3	"	20	"
Cumberland	2	"	10	"
Hunterdon	5	"	50	"
Passaic	1	"	10	"
Salem	10	"	150	"
Somerset	16	"	175	"
Union	1	"	8	"
Gloucester	6	"	55	"
	45	"	490	"

The State of Connecticut about five years ago liberated a number of Hungarian partridges, and some were put on the farms of two gentlemen whom Thorfin Tait, of Metuchen, N. J., met while on a visit to that State. Mr. Tait said the gentlemen informed him that they did not see a covey until this year, and that now on each farm there are several flocks, one containing 40 and the other about 15 birds.

During April and September a distribution of 5,903 English ring-neck pheasants was made. The Board was able to secure from the western United States a number of fine quail and 1,019 were liberated in good condition. We also secured a small sample lot of Mexican quail, which did not prove satisfactory.

Superintendent Duncan Dunn at the Farm continued his experiment of raising quail in captivity, and reports that with 35 breeders he raised 200.

Arrangements have been made for the purchase of a number of Western rabbits. Heretofore the problem of shipped rabbits arriving alive has prevented purchases, but the dealer with whom we have taken up the matter assures us that his manner of shipment will be satisfactory.

On the last three Wednesdays in October and the first Wednesday in November, 1915, when the hunting of deer was legal in this State, there were 503 deer and one elk killed, 290 does and 213 bucks. Of this number 481 were gathered by the hunters on the day of hunting, and 22 were found dead in the woods by persons at various times between the legal days and after the season had closed.

On the four days in which deer hunting was permitted, two persons were killed and four injured. It is possible that many more deer were killed than are included in this summary, but this is as near correct as the wardens of the counties could ascertain.

The following table shows the counties in which deer were killed, gives the number of does and bucks, number found dead and number of persons killed and injured:

County	Does	Bucks	Found Bucks	Dead Does	Elk	Persons Killed	Persons Injured
Atlantic	56	45	3	4	....	1	2
Bergen	16	7	....	1	1	....	....
Burlington	31	28	....	....	....	....	1
Cape May	8	9	....	....	....	....	1
Cumberland	55	35	2	3	....	....	....
Mercer	3	3	....	1	....	....	....
Morris	4	4	....	3	....	....	....
Ocean	45	31	3	2	....	....	....

Passaic	4	5	...	...	...	...	...
Salem	4	8	...	...	...	...	...
Sussex	4	4	...	...	...	1	...
Warren	46	26	...	...	...	...	...
Total	276	205	8	14	1	2	4

We obtained a few rabbits and squirrel by trapping them on the South Mountain Reservation of the Essex County Park Commission, and we bought 48 rabbits in the West, but only 40 survived the journey.

The Board sent out a circular letter to each warden to make inquiries in his county as to the practicability of securing farmers to plant cowpeas, buckwheat, kaffir corn or other suitable peas for grain and to let the same stand as food for birds. From several favorable replies received it was thought at first that a fine work could be conducted along this line. The State bought the seed and in some few cases paid for the plowing and planting, at a total cost of \$255.43. It appears that the benefits received do not justify a repetition of the expense.

State Game Farm.—In order to straighten lines at the Game Farm the Board acquired three pieces of land from three persons at a cost of \$980, and condemnation proceedings have been begun to obtain an adjoining tract of 10 acres.

It was found necessary to restrict admission of visitors at the Game Farm during the breeding season, and to that end regulation was made to have the Game Farm open to the public on week days from 10 A. M. to 4 P. M. and Sundays from 1 P. M. to 5 P. M. from August first to April first, with admission only by card and under restrictions to be decided by the Board.

Duncan Dunn, Superintendent of the State Game Farm, Forked River, in his fourth annual report says:

"We fenced in ten acres of woods with a six foot fence for a pheasant pen, built one thousand feet of Knox fence along the road leading to the bay; fixed three rooms over the carpenter shop for sleeping quarters for the men; painted and papered inside of small cottage on farm; laid 225 feet of gas pipe, put a gaslight in engine house to have light to start the engine in case of fire; also erected a gas lamp to give light around buildings; laid 100 feet of water pipe in pheasant pens, and 300 feet of board runs to carry water through bird pens; rebuilt 150 crates for shipping out pheasants; rebuilt 40 deer crates for shipping out deer; moved the deer fence across the bottom of field down at the meadows, so

that the deer can get on both sides of woods; rebuilt 8 pens for the fancy birds.

"Plowed up ground and sowed 18 acres of oats, 5 acres of millet, 5 acres of buckwheat, and 4 acres of rape; plowed up all the bird pens, limed them, and seeded them down in grass, also limed a 10 acre field. Planted 800 privet hedge, 50 shrubs, and 12 maple trees at the Superintendent's house. Transplanted shrubs and trees at Gate Lodge. Scraped and sprayed all the apple trees in orchard.

"Fixed up the road leading down to duck pond and carted two carloads of gravel from the depot and put it on the road. Carted 40 loads of gravel from Murray Grove for walks and roads, a distance of $5\frac{1}{2}$ miles round trip. Hauled 5 carloads of manure from the depot and spread it on the fields, and hauled one carload of coal from the depot, a distance of three miles round trip. Cut and hauled 20 loads of cedar brush for the breeding pens. Harvested 25 tons of hay, 10 tons of oats, and 50 loads of ice; cleaned out the chicken houses twice a month and sprayed them well with a disinfectant; dipped 550 rearing coops, 550 bottom boards, 150 frames and 200 feed boards in a disinfectant, and then carted them out to rearing field. Sprayed the hatching house well, and then cut 600 sods and put them in the boxes for nests; hauled out 30 loads of logs from woods and cut and sawed the same.

"Mated off my breeding pheasants, which were 500 stock birds, and clipped their wings. During the months of April and September we made a distribution of pheasants; also shipped out 58 wild turkeys and 30 deer. Hatched out 6,700 pheasants and put 5,000 in pens; a lot got away that we could not catch up. Kept 35 pair of quail for breeders and raised 200. We had three wild turkeys for stock and raised 30, also raised a number of golden and silver pheasants, and mallard ducks. The vermin have been quite bad this year. The rats and crows were especially troublesome. We killed 50 cats, 14 weasels, 11 opossums, 6 coons, 200 rats, 150 crows and other vermin."

Organization.—The Board organized on December 14th with the re-election of Commissioner Napier as President, and Commissioner Logue as Treasurer. Commissioner Faunce entered into a new term of four years, dating from November 25th. Commissioner Shanley was designated to act as President in the absence of the President at any time during the year.

The Board met every month. Our members frequently came to the Capitol in connection with work of the Board, and in consideration of bills before the Legislature.

Codification.—Joint Resolution No. 8, approved March

21st, 1916, provided for a commission to codify the fish and game laws. Protector James M. Stratton was appointed to represent this Board on the Commission, and William C. French, of Camden, was appointed by the Governor to the Commission. The other members of the Commission were: Representing the Assembly, Hon. Raymond Sheppard, of Haleyville, Cumberland County, and Hon. Harry W. Mutchler, of Rockaway, Morris County; representing the Senate, Hon. Thomas A. Mathis, of Toms River, and Hon. John A. Ackley, of Vineland, Cumberland County. The Commission had a meeting, but up to date the Board is not advised as to any recommendations it has made in reference to the laws. The Commission organized with Senator Mathis, President; Assemblyman Sheppard, Secretary, and Mr. William C. French as legal adviser.

Trucks, Ford Cars.—During the year the Board purchased three Garford trucks, a Garford truck which was in the service of the Commission having been taken in exchange as part payment for two new trucks. The last two trucks purchased were $1\frac{1}{2}$ ton trucks, it being considered that a greater service could be secured by trucks of this weight than those of two tons. This makes a total of three trucks in use. These trucks are indispensable in the distribution of fish and birds. In former years the Board received many complaints of fish and birds arriving in bad condition when they were shipped by express.

The Board purchased four additional Ford cars, one being for the use of Assistant Protector Harry E. Cudney, one for the Hatchery, and one each for Warden William Henry Small, of Englewood, Bergen County, and Warden Jacob D. Roe, of Newton, Sussex County. These purchases were made because the reduction in the price of cars made these cars practically as cheap as motorcycles. It has been found that a small automobile can reach places inaccessible to a motorcycle, and besides its use in the work of the Board is greater. At the present writing there are six Ford cars in use. The cars not mentioned above are in charge of Assistant Protector Howard Mathis and at the State Game Farm.

Wardens.—In December the services of Edward R. Davis as Warden for Salem County were dispensed with, and on September 12th David A. Thompson, Jr., of Salem, was appointed Warden on probation to fill the vacancy, Mr. Thompson having been certified to the Board as an eligible by the Civil Service Commission.

Garret P. Thorne, of Holmdel, P. O. Matawan, R. F. D.,

following his certification to this Board as an eligible for appointment as Warden, was so appointed and commenced his duties January 15th.

John F. Cox and John B. Bailey, of Washington, were appointed in October as temporary Wardens for the protection of the Buckwood Park Preserve, which was leased by the State, and a reference to which is made in another part of this report.

Several of our Wardens who have been designated as Federal Wardens for the bringing of prosecutions under the U. S. Migratory Game Law gave assistance in investigations on land and water to Philip S. Farnum, District Inspector.

During the winter's heavy snows the Wardens were successful in locating quail and pheasants, and putting out feed for them.

New Jersey and Adelaide.—The principal work of patrolling the waters of the State was done by the Board's launches "New Jersey" and "Adelaide." The "New Jersey" covered the Atlantic Ocean, Sandy Hook Bay, Raritan Bay, Delaware River and Bay, and the supervision of the pound net and menhaden fishing industry, and for the enforcement of laws pertaining to these waters. The "Adelaide" did service in Barnegat Bay, Great Bay, Metedeconk River, Mullica River, Great Egg Harbor River, and other waters, looking after illegal shooting, duck shooting at night, shooting ducks from power boats, etc.

Deputy Wardens.—A circular letter was sent to all deputy wardens in February to the effect that thereafter they should not commence any fish and game prosecution in the matter of drawing a complaint until they had consulted with the nearest regular paid Warden. In cases where it was necessary to make a summary arrest the deputy was informed that he could make the same and also the complaint, but he must immediately notify the Warden for the purpose of having the Warden examine and approve the form of the complaint. This action was necessary because so many persons who were deputies drew complaints which did not stand the test of the courts, entailing considerable annoyance and expense on the Board.

The Prosecutor of Hudson County succeeded in having former Deputy Warden Edward Rayner extradited from New York State on an indictment for making arrests for violation of the fish and game laws after his removal from office, and retaining moneys received for fines imposed for such violations. He pleaded guilty to all the charges before Judge

Sullivan, and was committed to the Hudson County Penitentiary for a period of eighteen months.

Drum Fish.—Complaints had been made that drum fish were destroying oysters in Tuckerton and Great bays, the complaint having been laid before the Board by George A. Mott, Director of the Bureau of Shell Fisheries, and upon his request permission was granted to dynamite the fish, with the understanding that the work was to be done in the presence of an officer of this Commission, and that if in the Board's judgment any large quantity of food fish was destroyed the permission should be revoked. Later, Mr. Mott informed us that because of the carelessness of the oyster planters in not procuring the necessary equipment in time the drum fish destroyed large quantities of oysters and some clams and got away before the oystermen were ready to dynamite them.

Pollutions—The State Board of Health has admirably co-operated with this Department in the matter of complaints respecting pollutions of our waters. Blank forms of complaints of pollutions were prepared by the Board of Health and distributed to our wardens, which they fill out in a preliminary investigation of reported pollutions.

Starlings.—There was an increasing number of complaints regarding destruction caused by starling colonies, and 19 permits were issued, in accordance with law, to municipalities to destroy starlings. It might be stated that starlings are protected as insectivorous birds and they may only be destroyed on a permit from this Board, following an application from the governing authorities of a municipality to the effect that they have become a nuisance in the municipality. It is claimed that this bird, which is rapidly increasing, drives away our native birds.

Conference on Shad.—In January W. W. Welsh, of the U. S. Bureau of Fisheries, attended a conference of the Board with a delegation of Burlington County fishermen. As is well known, there had been a startling falling off in the number of shad caught in the Delaware, and the Burlington delegation presented the following recommendations:

To close the shad season May 31st.

To close season for suckers April 10th.

To close season for carp April 10th.

That the season for catfish and eels with fyke nets should begin August 1st and close April 10th.

That the season for taking catfish with seines should be from September 1st to April 10th.

That the meshes for gill nets for taking shad should be not smaller than $5\frac{3}{4}$ inches.

That the meshes of hauling seines should be not smaller than 3 inches.

That the meshes for taking suckers should be not smaller than 3 inches.

The minutes of the Board say:

"It was the opinion that the Delaware River laws could only be changed through joint action with Pennsylvania, the Legislature of which State does not meet until next year (1917).

"The Board took under advisement the matter of making changes in the law."

Mr. Welsh said that the U. S. Bureau of Fisheries would include the Delaware river in an investigation of the shad industry from Florida to Maine. He reported that the supply of pelagic food fishes is very irregular, and that fluctuations of this character are well illustrated by the Scandinavian herring fisheries, of which more or less authentic records have been preserved for more than 500 years. It has been found by modern methods of research that in several consecutive years of successful herring fisheries, the majority of the catch represents the hatch of a single year, when conditions were favorable for the survival of a relatively large percentage of the eggs laid. This has been proved by determining the age of the individuals in large samples of each year's catch.

Mr. Welsh believed that the pollutions of the Delaware river interfered little with the up-river movement of the adult shad, but that the pollutions, especially oil on the surface, worked great harm to the fry and young during their first summer, by destroying vegetation amongst which the natural food originates, and by discouraging or preventing the natural method of feeding on insects at the surface.

It appeared certain that pollution had practically destroyed great areas of spawning grounds immediately below Philadelphia. Mr. Welsh added that he had no recommendation to make at this time, except that it would be advisable to change the shad season in any way that would allow a greater number of adult fish to reach suitable spawning grounds.

A delegation of shad fishermen from Burlington County came before the Board and expressed a wish to save and fertilize shad eggs if arrangements could be made to transport the eggs to the Pennsylvania hatchery at Torresdale, with a

view to stocking the Delaware river. Commissioner N. R. Buller, of Pennsylvania, co-operated with us in such a work in May. The launch "New Jersey" delivered pails to the fishermen between Beverly and Tullytown, and arrangements were made to receive them at any time, day or night, and transport them to the hatchery. A similar collection of eggs was made on the Cohansey river. We succeeded in collecting about 3,600,000 eggs, but Superintendent J. R. Berkhouse, of the hatchery, informed us that by reason of the low temperature of the water they could not be transported to the headwaters of the Delaware river, which we desired to do, and it was necessary to plant the eggs in the Delaware river at the mouth of Rancocas creek at Riverside.

The State Shad Industry.—Protector James M. Stratton makes the following interesting report on the shad industry of the State:

In view of the continual decrease in the catch of shad in the Delaware River and Bay, I have prepared statistics showing the number of nets and boats used, number of men engaged, number of shad caught, amount realized from the sale of shad, and the value of the boats and nets used, during the past season, together with a comparison of the same during the year 1913, which was the date of my last census on this subject.

The data for this report was obtained through the wardens of the counties in which the fishing was done, from the captains of the vessels engaged in carrying the shad to the wholesale market in Philadelphia, and from personal interviews with fishermen. The report is probably as accurate as is possible to obtain, and includes the counties of Cumberland, Salem, Gloucester, Burlington and Mercer. It seemed to be impracticable to obtain a complete and definite report from Camden county, as there was only about one-third of the number of men engaged in the business as in 1913, many of whom only went out two or three times, caught no fish, and put their nets away for the season. Some fishermen purchased new nets which were not put in the water the past season; and the few fish caught in that county were sold on the streets in the city of Camden or Gloucester by the netters.

I have not included Hunterdon, Warren and Sussex counties, where in former years there was considerable shad fishing. It was a matter of common knowledge in these localities during the past season that the catch was practically nothing, and less than in former years, which goes to emphasize the fact of the general decrease in shad.

Many persons who were formerly engaged in shad fishing are

now steadily employed at good wages in Du Pont's and other munition plants along the Delaware River. This, in addition to the gradual falling off in the catch for the past two or three years, is a reason for the decrease in the number of men engaged during the past year.

This census shows a decrease in the number of nets in operation and number of persons engaged in the business. It will also be noted that notwithstanding the fact that the price of shad has advanced 100% during the past three years, the catch of shad has decreased more than one-half million fish. In 1913 the average price of shad was 35c. to 40c. each. During the past year the fishermen received from 60c. to 80c. each, and in many cases good roe shad could be readily sold in many places from \$1 to \$1.75. The amount realized from the sale of the fish is nearly \$150,000 less than the year 1913.

Many theories are advanced as to the cause of this decrease, and various remedies are suggested as to the best method of increasing the supply. The fishermen who are engaged in the business in Delaware Bay and the lower portion of the Delaware River generally attribute the decrease to the lack of propagation of shad and to the refuse from the Du Pont Powder Works at Pennsville, and Gibbstown, and other factories along the river. The fishermen in Camden, Burlington, Mercer and Hunterdon counties attribute the scarcity of shad in those counties to the long nets which are used in Delaware Bay and in the mouth of the Delaware River, and advocate the use of shorter nets. The length of nets used in the lower part of the river and bay is 600 to 800 fathoms, while in the upper part of the river 100 to 150 fathoms is the maximum limit.

Above Trenton Falls gill nets are prohibited, and fishing is confined to hauling seines.

Some fishermen advocate a license to fish for shad or a closed period for a term of years.

FISH AND GAME COMMISSION.

DELAWARE RIVER AND BAY SHAD FISHING STATISTICS.

COUNTY	1916 Boats and Nets	Decrease in No. Boats and Nets Since 1913	Increase in No. Boats and Nets Since 1913	1916 Men Employed	Decrease in Men Since 1913	Increase in Men Since 1913	1916 Shad Caught	Decrease in Shad Caught Since 1913	1916 Value of Fish Caught	Decrease in Value of Fish Caught Since 1913	1916 Value Boats and Nets
Cumberland.....	87	26	....	274	52	....	63,000	\$133,000	\$34,650	\$41,790	\$52,200
Salem.....	126	12	....	252	24	....	103,200	206,569	67,080	53,729	75,600
Gloucester.....	67	....	16	134	....	22	46,000	35,000	27,600	750	18,000
Burlington.....	72	15	....	143	60	....	11,867	90,983	8,781	27,215	8,590
Mercer.....	21	23	....	47	41	..	3,400	44,400	3,160	15,960	3,300
Totals.....	373	76	16	750	177	22	227,467	\$509,952	\$141,271	\$139,444	\$157,690

RECAPITULATION

	Bots and Nets	Men En- gaged	Shad Oaught	Value of Fish Oaught	Value Bots and Nets
1913.....	433	905	737,419	\$280,717.41	\$161,350.00
1916.....	373	750	227,467	141,271.00	157,690.00
Decrease since 1913.....	60	155	509,952	\$139,446.41	\$ 3,660.00

Miscellaneous.—On December 1st the Secretary and Protector appeared before the Assembly Committee investigating the fish pound industries and gave the Committee the information they desired from them.

The Committee of 1915 to investigate pounds was continued for 1916, the membership being as follows: Edward Schoen, Newark, Chairman; Hon. Alonzo D. Herrick, Hackensack; Hon. Wm. N. Runyon, Plainfield; Hon. Bertram E. Whitman, Pleasantville; Hon. Harry E. Johnson, Newark.

W. A. Roberts and Arthur Orr, representing the U. S. Bureau of Fisheries, inspected the Board's records of pound fisheries in connection with their statistical canvass of the fisheries of New Jersey and New York.

President Napier and Protector Stratton, on invitation of Commissioner Pratt, of the New York Conservation Commission, attended a conference at Washington, D. C., with U. S. Commissioner H. M. Smith, on the subject of marine fisheries.

The Legislature visited the State Fish Hatchery February third, and the State Game Farm February tenth, together with other State officials. Many of the members, who did not have previous information as to the work being done by the Board, expressed surprise at the magnitude and completeness of both plants.

NEW JERSEY LEGISLATION IN 1916.

CHAPTER 30. Fixes a season for coots, commonly called crow ducks, from October first to March fifteenth.

CHAPTER 93. Prohibits the destruction of nets or the taking of fish from nets without the consent of the owner.

CHAPTER 130. Makes it unlawful for any person to go in the woods or fields at any time with a gun or firearm when intoxicated or under the influence of any drugs or intoxicating liquors.

CHAPTER 138. Authorizes the Board of Fish and Game Commissioners to acquire by condemnation or otherwise land in this State to be used for the propagation of fish and game. Applies to the straightening of lines at the Game Farm.

CHAPTER 194. Prohibits the use of nets in the waters of Peck's Bay, Garret thoroughfare, Beach thoroughfare, Dry thoroughfare, Finger channel, Rainbow channel, Great Egg Harbor Bay or Great Egg Harbor inlet, in the county of Cape May, between the first day of June and the first day of September in any year.

CHAPTER 245. Prohibits vessels over 40 tons from using purse nets in Sandy Hook and Raritan Bay.

CHAPTER 286. Authorizes the Fish and Game Commission to lease land for game refuges, but act applies only to Warren and Sussex counties.

CHAPTER 265. Amends the act of 1915 by permitting the use of nets in Sandy Hook Bay.

JOINT RESOLUTION No. 3, provides for a codification of the game laws.

CHAPTER 262. Prohibits the killing of does and fawns. No change in season.

JOINT RESOLUTION No. 5, provides for continuation of investigation of fisheries industry.

FISH AND GAME COMMISSION.

25

SUPPLEMENT TO 1914-1915 REPORT.

To Conform with Requisition System.

INCOME.

Balance, as per statement in last printed report, Oct. 31, 1915....	\$34,038.75
Less Lapse—	
Act of 1908.....	\$1,146.41
Fines Account	1,197.30
Appropriation, Annual	21.83
Appropriation, Special Supplemental.....	24.05
	<hr/>
	2,389.59
	<hr/>
	\$31,649.16

EXPENDITURES.

Paid after Nov. 1, 1915, on requisitions for 1914-1915—	
Resident License Fund.....	\$ 473.53
Game Protection Fund.....	3.50
Hunters' and Anglers' License Fund.....	3,303.04
Act of 1908.....	1,185.05
Fines Account	869.45
Appropriation, Annual	206.57
	<hr/>
	6,041.14
To Balance	25,608.02
	<hr/>
	\$31,649.16

FINANCIAL STATEMENT.**INCOME.****Balances November 1, 1915—**

Resident License Fund.....	\$	921.99	
Game Protection Fund.....		5.09	
Hunters' and Anglers' License Fund.....		24,680.94	
		<hr/>	\$ 25,608.02

Receipts—

Resident License Fund.....	\$	174.75
Hunters' and Anglers' License Fund.....		101,947.05

Act of 1908 Account—

Menhaden Licenses	\$5,325.00
Pound Licenses	5,510.00
Breeders' Licenses	330.00
Sundries	474.15
Sales	985.29
	<hr/>

12,624.44

Fines Account	6,330.11
	<hr/>

121,076.35

\$146,684.37**EXPENDITURES.**

Hunters' and Anglers' License Fund.....	\$	98,621.17
Act of 1908.....		11,727.95
Fines Account		5,069.89
Game Protection Fund.....		5.09
		<hr/>
To Balance		\$115,424.10
		<hr/>
		*31,260.27
		<hr/>
		\$146,684.37

* Cash balance subject to bills for which requisitions have been made.

Document No. 39

REPORT
OF THE
BOARD OF SHELL FISHERIES

For the Year ending October 31st, 1916

**Embracing the Annual Reports of the Board of Shell
Fisheries, comprising the Department of the
Maurice River Cove and the Department
of the Atlantic Coast**

STATE OF NEW JERSEY

REPORT

of the

Board of Shell Fisheries

For the Year Ending October 31

1916

Embracing the Annual Reports of the Board of Shell
Fisheries, comprising the Department of the
Maurice River Cove and the Department of the Atlantic Coast

TRENTON, N. J.
MACCRELLISH & QUIGLEY Co., State Printers

1917

Board of Shell Fisheries.

Director.

GEORGE A. MOTT,OFFICE, STATE HOUSE, TRENTON

Members of the Board of Shell Fisheries.

PETER C. COSIER,Newport
JOSEPH N. FOWLER,Port Norris
CHARLES COVERT,Leesburg
AUGUSTUS J. MEERWALD,South Dennis
ALFRED B. SMITH,Atlantic City
EDWARD K. ALLEN, Jr.,New Gretna
FRANK R. AUSTIN,Tuckerton
JOHN W. MASON,Keyport

Officers of the Board of Shell Fisheries.

PRESIDENT,

PETER C. COSIER.

SECRETARY,

GEORGE A. MOTT.

STANDING COMMITTEES.

Rules and Regulations—FRANK R. AUSTIN, A. B. SMITH and A. J. MEERWALD.

Legislation and Appropriation—CHARLES COVERT, JOSEPH N. FOWLER, A. B. SMITH and F. R. AUSTIN.

Sanitation—JOSEPH N. FOWLER, JOHN W. MASON and E. K. ALLEN, JR.

Officers and Employees of the Department of the Maurice River Cove.

CHIEF,

A. T. BACON, Mauricetown,

SUPERVISING ENGINEER,

SAMUEL M. SHELDON, Millville.

CHAIRMAN,

JOSEPH N. FOWLER.

SECRETARY,

CHARLES COVERT.

SPECIAL OFFICER AND PILOT OF STEAM GUARD BOAT "CYPHER,"

J. HAMMITT WEBB, Mauricetown.

CAPTAINS OF GUARD BOATS,

GEORGE C. BELL, Newport, Schooner "Leila Boyle."

J. HAMMITT LAKE, Port Norris, Schooner "Infanta."

Office of the Department, Bivalve.

Days of meeting, last Saturday in each month.

Officers and Employees of the Department of the Atlantic Coast.

CHAIRMAN,
ALFRED B. SMITH.

SECRETARY,
FRANK R. AUSTIN.

Office of the Department,
205 Humphrey Building, South North Carolina Ave.,
Atlantic City, N. J.

Days of meeting, last Saturday in each month.

Chief of the Division of Atlantic County.

EDMUND R. SMITH,OFFICE, 205 HUMPHREY BLDG., ATLANTIC CITY

Chief of the Division of Burlington, Ocean and Monmouth Counties.

C. D. KELLY,OFFICE, WEST CREEK

SUPERVISING ENGINEER,

R. F. RUTTER,West Creek

GUARDS.

JESSE THOMAS,Scullyville
ELIAS CONOVER,Port Republic
C. WASHINGTON ALLEN,New Gretna
MARK ENDICOTT,Port Republic
GEORGE MARSHALL,Tuckerton
JOHN W. RUTTER,West Creek

Report of the Board of Shell Fisheries.

To the Honorable James F. Fielder, Governor:

It affords us a very great degree of satisfaction to be able to report another successful year for the shellfish industry. We speak particularly of the great shipping center commonly known as Maurice River, which includes the shipping points of Maurice River and Bivalve. They are now in the midst of catching and shipping what they all agree is the finest and most valuable crop ever handled at those points, with the demand far exceeding the supply (this because of their inability to procure labor notwithstanding the fact that they are offering unheard of wages for that class of labor).

We would also report a very successful year for those districts which lie along the Atlantic coast, except a portion of Raritan Bay. The planters who occupy this part of Raritan Bay have been in the habit of planting large oysters from Virginia and shipping them from New York City during the summer, and have been quite successful in this line of business, but the Board of Health of the City of New York made a ruling prohibiting the shipment of oysters from the waters of Raritan Bay lying in New Jersey, notwithstanding the fact (we are told) that oysters from the immediate vicinity on the New York side were freely admitted, and we wish also to state that the New York City Board continued and have continued to prohibit the shipment of these oysters to that city, notwithstanding that these waters have been thoroughly examined by the Department of Health of New Jersey, the Federal Department of Health and the Federal Bureau of Chemistry, and by them declared to test up to a more than sufficient degree of purity for the purpose of the growing of oysters for market. We would also report that these New York City authorities have seized shipments of oysters from Maurice River, also from Tuckerton. These waters have been approved

by all the above-mentioned authorities who have jurisdiction. We wish to report a very fine crop of seed oysters on the coast, but only a fair crop in Delaware Bay, this because of a little neglect in enforcing the "rough cull" law for two or three years prior to the consolidation, since which time, however, we have strictly enforced the "rough cull" and hope to be able to give a more favorable report next year.

We very much regret to report that a few citizens of our State, from purely mercenary motives, have instituted proceedings for the confiscation and sale of some of the vessels engaged in the shellfish industry in Maurice River Cove, with the avowed purpose of taking in the whole fleet if successful in the cases mentioned. This action was taken under what is known as the Seventh Section of the old law of 1846 (and while we were of the opinion that this section was impliedly repealed by both the act to provide a uniform procedure for the enforcement of all laws relating to the taking of natural seed oysters and clams and the protection of the natural seed oyster grounds of this State, and for the recovery of penalties for the violation thereof, P. L. 1900, p. 425, and P. L. 1899, p. 506, Sec. 25, which makes all violation in Delaware River and Bay a misdemeanor and punishable by fine and imprisonment), which was one of the conditions which the Board of Shell Fisheries were so anxious to remedy in the act which they so earnestly advocated as a piece of progressive legislation at the last session of the Legislature, and are now more anxious than ever to have passed; and trust that a bill such as was proposed last year will receive the favorable consideration of the Legislature.

We also desire to call your attention to another feature of the bill which failed of passage, which was progressive, and designed to conserve what nature provides and the people destroy, that is, changing the season for taking seed oysters from the natural seed oyster grounds of the Atlantic coast. If that bill had become a law, one of the finest growths of seed that we have had in years would have remained on the natural beds until spring, when it would have been caught and planted by several hundred of our baymen under the most favorable conditions, whereas, it

has practically been destroyed by having been caught and moved in October and November, so that moving them at this season of the year is considered to be moving them under the most unfavorable conditions.

Having made a study of the needs and requirements for the improvement of the industry over which this Board has, or is supposed to have, control, we trust that the incoming Legislature will recognize the necessity of placing such laws upon the statute books as are required to give to the Board that power and control which will enable them to improve and develop this vast industry in a manner consistent with the opportunities that exist and that are well known to the Board.

We also desire to call your attention to an industry that from statements made in the following article (which was a clipping mailed to the Director by Mr. Charles H. Connor, whose letter also is published in this report) is receiving considerable attention in various parts of the country. We believe that in a number of the upper waters of the streams of New Jersey the conditions are ideal for the development of this industry, and we would recommend that this matter be given that inquiry and attention which would appear to be advisable in view of the statements of the following article and letter.

(Copy of Letter.)

1016 SOUTH CLEVELAND AVE.,

PHILADELPHIA, PA., Oct. 2, 1916.

Mr. George A. Mott, State House, Trenton, N. J.:

DEAR SIR—I thank you very much for copy of 1915 Report of the Board of Shell Fisheries recently received.

In correspondence with Mr. Chas. R. Bacon, in previous years, I had the honor of calling his attention to a valuable source of income to the State from shellfish that is being unfortunately neglected, namely, the freshwater mussels (*Naiades*). New Jersey still contains some of the more valuable of these shells, both as sources of pearls and pearl button supply. The enclosed clipping from the "Philadelphia Record" will, I think, strengthen my former contention in this matter. Being myself interested in the *Naiades*, from a scientific point of view, I wanted to carry out some investigations as to their life histories. This I began, and would gladly have continued at my own expense, could I have had a little co-operation—moral support from the State. The State could have had the full benefit of the results of those studies by simply placing the work under its patronage.

This would have prevented the interference with and destruction of specimens which I imported into the State for observation and study, which, for lack of such patronage, resulted in loss and failure.

It would have made a difference could it have been known that the State government was interested in the security and success of the investigation, and it would have enabled me, without expense to the Government, to put her citizens in the way of a new and profitable industry.

Yours truly,

(Signed) CHAS. H. CONNER.

Pearls are Destined to be Much Cheaper.

Mussel-Breeding Industry Promises to Make Such Luxury of Ornament Possible to Every Woman.

The time is fast approaching when pearls will be so cheap that the everyday woman who works for a living can afford to buy and wear a string such as only the wife or daughter of a millionaire would now be able to possess.

They will be big pearls, and she can have her choice of colors—pink, yellow, salmon, light green, purplish, sky-blue or of a bright red that makes them look like drops of molten copper.

She will owe this wonderful luxury of ornament to the pearl-mussel-breeding operations of the Government Fisheries Bureau, which (undertaken very recently at Fairport, Ia.) have already achieved surprising success. The shellfish dealt with yield the finest and most valuable pearls in the world, the color of the latter varying with different species of the mollusk.

Fairport is on the Mississippi river, eight miles above Muscatine. There the Fisheries Bureau has constructed 17 earth ponds, with a combined area of seven acres, and 14 small concrete-lined ponds, for use in experimental mussel breeding and for containing supplies of fishes.

The fishes are indispensable, being needed to serve as nurses for the baby mussels. Those bivalves in early infancy are (like oysters and clams) free-swimming animals—very minute drifting larvæ—and can survive only if they are lucky enough to attach themselves to the gills of a fish while undergoing a stage of their development. During this stage, in fact, they are parasites.

The baby mussel is provided with a pair of hooks resembling ice-tongs, by which to catch and hold on. In doing this it makes a slight wound, which at once begins to heal over, inclosing the infant mollusk within the tissues of the fish. There it remains for a couple of weeks, and then, freeing itself, falls to the bottom of the stream or pond, and takes up the business of life on its own independent account as a sedentary animal.

Now, under natural conditions only a few baby mussels out of a million, say, succeed in getting hold of fishes. The vast majority fail in this early ambition, and so perish. But the Fisheries Bureau adopts the expedient of collecting them by myriads when newly hatched and putting them into tanks with fishes, so that they can "catch on." Then the fishes are turned loose in the rivers.

By this simple means the Government experts during the last year provided 208,000 nurse fishes for 344,000,000 baby mussels, the latter at this stage of their existence being so tiny that one small fish (a sunfish, for example) can serve as nurse for 100 or even 2,000. The average cost of the work was less than three cents per 1,000 "babies."

FIRST STEPS OF MUSSEL FISHERMEN.

The first step is to visit pearl-mussel beds where mussel fishermen are at work, look over the catch, and pick out specimens of the finest varieties that show signs of being about to breed. These are opened, the "brood pouches" are cut with a pair of small scissors and the "babies" are squeezed out into a glass receptacle.

Meanwhile a lot of fishes have been netted from a convenient stream. They are put into a tank, and the "babies" are thrown in with them. From five to fifteen minutes must be allowed for the latter to attach themselves, the time being judged by scooping out a fish now and again with a hand-net and examining its gills. When the finny nurses are found to be sufficiently "loaded" they are emptied out of the tank into the river.

There are many species of pearl-mussels, and each one finds only certain kinds of fishes suitable for nurse purposes. Thus the "mucket" demands a fish of the sunfish family, such as the bass, crappie or bream. For the "pimple-back" (a very important species) the catfishes are very adapted. The "yellow sand-shell" (very valuable) calls for a garfish. The "nigger-head" seems to recognize as nurse only the river herring.

MANY TRIALS REQUIRED.

Many trials have been required to determine what kinds of fishes are best for different species of mussels, the aim always being to bring together the mussel and fish most suitable to each other. Very encouraging results have been obtained from experiments in rearing the young bivalves (after they have abandoned their nurses) in ponds and in floating crates.

It should, perhaps, be explained that under natural conditions the eggs of the pearl-mussel are hatched in brood pouches, from which they are finally thrown out in little triangular packets (a dozen or more), each about half an inch long. After lying on the bottom for a while each packet (a tiny envelope of mother-of-pearl) breaks open and liberates thousands of free-swimming young. These are the "babies" that carry miniature ice-tongs.

The experimental work here described was preceded by an exploration of the entire area watered by the Mississippi and its tributaries, the most important object of which was to locate the finest beds of pearl-mussels from which to obtain superior breeding stock.

In the spring, after the annual floods, many "overflow ponds" are left near the rivers, cut off from the latter by the recession of the waters. Such ponds commonly contain great numbers of fishes of just the kinds most desired the mussel-breeding work. Ordinarily they dry up and the fishes perish. But during 1915 the Fisheries Bureau managed to seine and utilize 66,645 of the finny unfortunates thus marooned, seining them out and liberating them after loading them with as many infant mussels as they could carry.

TO RESTOCK STREAMS.

It is proposed to restock with pearl-mussel the streams and lakes of the Mississippi Valley, wherein they were formerly so plentiful, and also to introduce the valuable mollusks into waters to which hitherto they have been strangers. This can be done either by shipping "inoculated" nurse fishes to the localities where they are wanted (to be liberated on arrival), or by gathering from the Fairport pond bottoms young mussels that have passed beyond the parasitic stage, and forwarding them in quantity, to be planted like "seed" oysters.

The cultivation of pearls (growing them like any agricultural crop) is merely one step beyond. It demands, to start with, a bed of mussels that is infested by the tiny worm that is the nucleus of every pearl. This peculiar species of worm bores its way into the flesh of the mollusk, which, to protect itself, "encysts" the parasite by wrapping it in a series of coats of pearl stuff.

It is easy to ascertain whether or not a mussel bed is infested by this parasite. If such is the fact, the presence of the worm is indicated by a pink spot in the flesh of the bivalve—in cases where there has not been time for a pearl to develop.

One other condition is requisite, however. There must be muskrats in the immediate neighborhood. For the pearl-making worm passes one of its life

stages in the body of the muskrat. The latter eats an infected mussel, thereby acquiring the parasite, which lays its eggs in the animal's intestines. Thence the eggs find their way into the water; the worms are hatched from them and attack other mussels, which are in turn eaten by other muskrats, thus completing the life cycle of the little pearl maker.

A pearl-producing plantation of the kind described would yield pearls of any color desired, according to the species of mussels selected for planting. It would produce only large pearls, because all mussels containing undersized ones would, after examination, be returned to the bed and kept there until the pearls had time to grow big. Experiments have shown that such inspection can easily be made without opening the shells by the use of an X-ray "fluoroscopy."

(Signed) RENE BACHE.

BOARD OF SHELL FISHERIES.

Leases and Licenses Issued.

	<i>Number of Acres.</i>	<i>Number of Licenses.</i>
Oyster Bed Leases, Atlantic County,	534.97	....
Propagating Oyster Beds,	176.32	....
Delaware Bay and Maurice River Cove,	27,423.00	230
Ocean County,	3,094.00	....
Raritan Bay,	406.00	11
Shark River,	188.00	....
Total,	<u>31,822.29</u>	<u>241</u>

TOTAL RECEIPTS FROM LEASES, LICENSES, ETC.

Atlantic County,	\$852 56
Delaware Bay, Maurice River Cove and Raritan Bay,	21,847 50
Burlington, Ocean and Monmouth Counties,	3,706 78
Total,	<u>\$26,406 84</u>

RECAPITULATION.

Total Acreage Leased,	31,822.29
Total Licenses Issued,	241.00
Total Receipts,	<u>\$26,406 84</u>

BOAT LICENSES—DEPARTMENT OF THE MAURICE RIVER COVE.

- 431, Adams, J. Wesley, Port Norris; Slp. Sophy and Ina; tonnage, 15; March 31, 1916; 1 year; \$22.50.
- 24, Anold, James, Fairton; Schr. Helen May Schoch; tonnage, 34; March 18, 1916; 1 year; \$51.00.
- 230, Armstrong, George, Delmont; Slp. Sherman; tonnage, 12; March 28, 1916; 1 year; \$18.00.
- 332, Bailey, A. J., Port Norris; Schr. C. W. and S. Peace; tonnage, 21; April 1, 1916; 1 year; \$31.50.
- 102, Baker, Walter, Bridgeton; Schr. Josiah S. Newcomb; tonnage, 33; April 30, 1916; 1 year; \$48.00.
- 39, Bass, George, Port Norris; Slp. A. M. Parris; tonnage, under; March 31, 1916; 1 year; \$10.00.
- 156, Batemen, Elmer, Port Norris; Ga. Sc. Wm. E. Fowler; tonnage, 30; April 4, 1916; 1 year; \$45.00.
- 52, Bateman, J. Roberts, Mauricetown; Schr. Roscoe S. Miller; tonnage, 20; January 1, 1916; 1 year; \$30.00.
- 31, Bateman, Moses, Mauricetown; Schr. Jane A. Smith; tonnage, 16; April 29, 1916; 1 year; \$24.00.
- 98, Bateman, William H., Greenwich; Schr. Maggie and Ruth; tonnage, 7; May 1, 1916; 1 year; \$10.50.
- 213, Blackman, Smith S., Port Norris; Schr. A. and E. Blackman; tonnage, 23; April 11, 1916; 1 year; \$34.50.
- 97, Bell, George C., Jr., Bivalve, Ga. Sc. James Mulvey; tonnage, 18; March 25, 1916; 1 year; \$27.00.
- 349, Bell, John S., Newport; Ga. Sc. Mattie B. Sheppard; tonnage, 14; March 24, 1916; 1 year; \$21.00.
- 81, Berry, Benjamin, Port Norris; Schr. Arabelle; tonnage, 26; March 31, 1916; 1 year; \$39.00.
- 199, Berry, Harry, Port Norris; Schr. Marcus L. Godfrey; tonnage, 24; April 1, 1916; 1 year; \$36.00.

BOARD OF SHELL FISHERIES.

13

- 82, Berry, John, Port Norris; Schr. Annie C. Johnson; tonnage, 32; April 30, 1916; 1 year; \$48.00.
- 106, Berry, Philip, Port Norris; Schr. Francis T. DuBois; tonnage, 23; March 31, 1916; 1 year; \$34.50.
- 5, Berry, Stuits, Port Norris; Schr. Anna and Helen; tonnage, 32; March 31, 1916; 1 year; \$48.00.
- 562, Blissard, George M., Cedarville; Slp. Samuel Hanners; tonnage, 10; April 26, 1916; 1 year; \$15.00.
- 208, Blissard, Hiram, Cedarville; Slp. Mary and Emma; tonnage, 10; April 28, 1916; 1 year; \$15.00.
- 202, Blissard, William F., Cedarville; Slp. Mattie B.; tonnage 10; March 29, 1916; 1 year; \$15.00.
- 96, Bradford, Charles L., Newport; Schr. Chas. L. Bradford; tonnage, 33; April 1, 1916; 1 year; \$52.50.
- 250, Bradford, Lemuel, Newport; Schr. Samuel C. Lake; tonnage, 26; April 1, 1916; 1 year; \$39.00.
- 37, Bradford, Lucius E., Newport; Schr. T. B. Husted; tonnage, 27; January 1, 1916; 1 year; \$42.50.
- 450, Brant, Robert, Fairton; Schr. Mattie P. Flavelle; tonnage, 33; March 25, 1916; 1 year; \$49.50.
- 42, Brineshults, John M., Cedarville; Schr. James O. Sheppard; tonnage, 33; October 5, 1916; 1 year; \$49.50.
- 219, Bornhorst, August, Port Norris; Schr. Finette Bornhorst; tonnage, 17; April 26, 1916; 1 year; \$25.50.
- 473, Bowker, Elias, Dividing Creek; Schr. Helen and Lottie; tonnage, 16; April 1, 1916; 1 year; \$24.00.
- 588, Bowker, Thomas, Port Norris; Schr. Village Belle; tonnage, 21; April 29, 1916; 1 year; \$31.50.
- 126, Buck, George H., Bridgeton; Slp. Lorella H. Sharp; tonnage, under; March 1, 1916; 1 year; \$10.60.
- 249, Burnight, Jacob, Dividing Creek; Slp. Bertie B.; tonnage, under; April 28, 1916; 1 year; \$10.00.
- 25, Burt, George B., Cedarville; Schr. Maggie S. Myers; tonnage, 24; May 27, 1916; 1 year; \$36.00.
- 139, Butcher, Samuel, Helsleville; Slp. A. E. Andrews; tonnage, 10; April 13, 1916; 1 year; \$15.00.
- 180, Cain, Ellis L., Port Norris; Marian Mayne; tonnage, 16; March 31, 1916; 1 year; \$24.00.
- 34, Campbell, Clement L., Bridgeton; Schr. M. D. and Belle Mulford; tonnage, 30; March 22, 1916; 1 year; \$45.00.
- 227, Campbell, Peter, Newport; Schr. Mary W. Mears; tonnage, 33; April 19, 1916; 1 year; \$49.50.
- 241, Campbell, Philip F., Newport; Schr. Sarah A. Melson; tonnage, 26; March 29, 1916; 1 year; \$39.00.
- 426, Campbell, Stetson L., Port Norris; Schr. Sunlight; tonnage, 26; April 5, 1916; 1 year; \$39.00.
- 133, Campbell, Walter J., Port Norris; Schr. Daniel M. Bateman; tonnage, 18; April 1, 1916; 1 year; \$27.00.
- 110, Campbell, Winfield A., Bivalve; Schr. Bay Queen; tonnage, 19; March 24, 1916; 1 year; \$28.50.
- 218, Campbell, Wilson A., Newport; Schr. Imelda Campbell; tonnage, 30; April 1, 1916; 1 year; \$45.00.
- 325, Chance, E. W., Mauricetown; Schr. John E. Mehrer; tonnage, 25; April 28, 1916; 1 year; \$37.50.
- 137, Chew, William V., Port Norris; Schr. J. W. Fennimore; tonnage, 15; April 20, 1916; 1 year; \$22.50.
- 16, Clark, Joshua, Port Norris; Schr. Jeremiah N. Ogden, tonnage, 35; paid in April, due December, 1916; 1 year; \$52.50.
- 262, Clark, John, Port Norris; Slp. Water Lily; tonnage, 12; January 1, 1916; 1 year; \$18.00.
- 12, Clark, John, Port Norris; Schr. Columbia; tonnage, 21; October 12, 1916; 1 year; \$31.50.

- 98, Clark, William W., Port Norris; Schr. Delaware; tonnage, 18; April 30, 1916; 1 year; \$27.00.
- 147, Chester, Cornelius, Heislerville; Schr. Sarah C. Lee; tonnage, 18; April 1, 1916; 1 year; \$19.50.
- 43, Conahay, George R., Port Norris; Schr. William Dennis; tonnage, 18; April 12, 1916; 1 year; \$27.00.
- 168, Corson, Dudley, Port Norris; Slp. Robert Lambden; tonnage, 9; April 11, 1916; 1 year; \$13.50.
- 75, Cosler, Lucius E., Newport; Schr. Valentine Cosler; tonnage, 26; March 31, 1916; 1 year; \$39.00.
- 6, Cosler, William W., Dividing Creek; Schr. Falcon; tonnage, 21; April 3, 1916; 1 year; \$31.50.
- 427, Cox, Champion H., Leesburg; Schr. Harry and Willie; tonnage, 14; April 1, 1916; 1 year; \$21.00.
- 150, Cox, Lilburn, Leesburg; Schr. Almira Cox; tonnage, 18; September 22, 1916; 1 year; \$27.00.
- 41, Cox, Raymond, Cedarville; Schr. Henry S. Robbins; tonnage, 18; April 27, 1916; 1 year; \$27.00.
- 479, Crosaley, George B., Newport; Schr. Bicycle; tonnage, 16; March 31, 1916; 1 year; \$24.00.
- 191, Cruise, Benj. B., Mauricetown; Schr. Araminta; tonnage, 27; April 1, 1916; 1 year; \$40.50.
- 411, Covert, Chas. A., Leesburg; Schr. Harry and Charlie; tonnage, 15; April 2, 1916; 1 year; \$22.50.
- 67, Corson, Wm. A., Leesburg; Slp. Treasurer; tonnage, 10; April 30, 1916; 1 year; \$15.00.
- 32, Diamant, William A., Cedarville; Schr. Stanton; tonnage, 22; September 23, 1916; 1 year; \$33.00.
- 55, Daniels, David B., Bridgeton; Schr. Mary and Margaret; tonnage, 21; April 3, 1916; 1 year; \$31.50.
- 475, Dolson, Ferdinand, Cedarville; Slp. Mary E. Adams; tonnage, 10; April 19, 1916; 1 year; \$15.00.
- 135, Donnelly, Lorenzo G., Heislerville; Schr. T. O. Ladow; tonnage, 24; April 27, 1916; 1 year; \$36.00.
- 54, Earl, Dunham, Port Norris; Slp. Remington; tonnage, 16; April 27, 1916; 1 year; \$34.00.
- 236, Earl, Thomas, Port Norris; Slp. Warren R. Miller; tonnage, 10; January 20, 1916; 1 year; \$15.00.
- 15, Emerson, Horatio F., Cedarville; Schr. Richard Vaux; tonnage, 24; April 18, 1916; 1 year; \$36.00.
- 49, Errickson, Samuel W., Leesburg; Schr. Florence Errickson; tonnage, 38; April 2, 1916; 1 year; \$57.00.
- 537, Evans, Edgar L., Millville; Schr. Boyd N. Sheppard; tonnage, 32; April 1, 1916; 1 year; \$48.00.
- 154, Evans, Norman, Millville; Schr. Alice and Mary; tonnage, 20; April 1, 1916; 1 year; \$30.00.
- 114, Fauver, William, Heislerville; Slp. George W. Jackson; tonnage, 10; April 1, 1916; 1 year; \$15.00.
- 266, Ferguson, Leo, Leesburg; Schr. Steelman R. Lee; tonnage, 17; April 1, 1916; 1 year; \$25.50.
- 392, Fidler, Frank, Dennistville; Schr. Martha Ann; tonnage, 18; March 30, 1916; 1 year; \$27.00.
- 197, Fithian, J. B., Greenwich; Slp. Lillian; tonnage, 8; April 27, 1916; 1 year; \$13.00.
- 14, Flynn, John, Camden; Ga. Sc. M. A. Howlett; tonnage, 31; April 12, 1916; 1 year; \$46.50.
- 188, Foster, John, Newport; Slp. Dart; tonnage, 11; April 29, 1916; 1 year; \$16.50.
- 88, Gandy, Miles, Cedarville; Schr. Laura M. Bucksom; tonnage, 28; April 1, 1916; 1 year; \$42.00.
- 90, Garrison, Austin, Bridgeton; Slp. Minnie M. North; tonnage, 7; March 14, 1916; 1 year; \$10.50.
- 131, Garrison, Charles, Bridgeton; Schr. Anna and Marie; tonnage, 14; April 29, 1916; 1 year; \$21.00.

20. Garrison, Daniel C., Healserville; Slp. Olive Mulford; tonnage, 12; March 25, 1916; 1 year; \$18.00.
170. Garrison, Richard, Port Norris; Schr. E. A. Cranmer; tonnage, 18; October 12, 1916; 1 year; \$27.00.
161. Gaskill, Elcana, Port Norris; Ga. Sc. Linda M. Sockwell; tonnage, 42; April 15, 1916; 1 year; \$68.00.
85. Gaskill, Edward, Bridgeton; Schr. Grover Cleveland; tonnage, 32; March 26, 1916; 1 year; \$48.00.
17. Gaskill, Linwood, Port Norris; Schr. L. E. Yates; tonnage, 37; March 28, 1916; 1 year; \$55.50.
341. Gates, James, Newport; Schr. North Star; tonnage, 25; April 6, 1916; 1 year; \$37.50.
400. Goff, Oliver, Healserville; Ga. Sc. Anna W. Neal; tonnage, 16; March 29, 1916; 1 year; \$24.00.
268. Green, Socrates, Port Norris; Slp. Shamrock; tonnage, 11; April 27, 1916; 1 year; \$16.50.
72. Hagerty, Elmer, Greenwich; Schr. Annie R. Shillingsburg; tonnage, 45; April 12, 1916; 1 year; \$67.50.
229. Hand, Harrison, Port Norris; Slp. Gypsy; tonnage, 16; March 31, 1916; 1 year; \$24.00.
205. Hand, Leonard C., Port Norris; Schr. B. H. Minch; tonnage, 21; April 22, 1916, to September 1, 1916; \$31.50.
485. Hanners, McClellan, Newport; Schr. H. L. Steelman; tonnage, 19; April 16, 1916; 1 year; \$28.50.
10. Hannen, Otto, Cedarville; Schr. Almeida; tonnage, 21; April 1, 1916; 1 year; \$31.50.
236. Harrington, Gerald, Port Norris; Schr. J. Calhoun Johnson; tonnage, 26; April 28, 1916; 1 year; \$39.00.
480. Hasher, Lummis, Port Norris; Ga. Sc. Mary & Ida; tonnage, 10; April 28, 1916; 1 year; \$15.00.
205. Hasher, Lummis, Port Norris; Schr. B. H. Minch; tonnage, 21; September 1, 1916; 1 year; \$31.50.
246. Henderson, George, Millville; Slp. Effie; tonnage, under; April 30, 1916; 1 year; \$10.00.
267. Henderson, Zadok, Leesburg; Slp. Thomas S. Lee; tonnage, 12; April 27, 1916; 1 year; \$18.00.
79. Hignutt, Frank, Port Norris; Schr. William C. Lore; tonnage, 31; April 1, 1916; 1 year; \$46.50.
51. Hillman, Chas. L., Leesburg; Schr. Scarborough; tonnage, 34; April 22, 1916; 1 year; \$51.00.
4. Hinson, Arthur, Mauricetown; Schr. Walter Bateman; tonnage, 32; September 21, 1916; 1 year; \$48.00.
155. Hoffman, Silas, Port Norris; Schr. Ellanora; tonnage, 38; April 28 1916; 1 year; \$49.50.
239. Hoffman, William, Leesburg; Schr. Carey; tonnage, 31; April 1, 1916; 1 year; \$46.50.
585. Holmes, Edward, Pierces; Slp. Friendly; tonnage, 17; April 24, 1916; 1 year; \$25.50.
23. Hollinger, George, Port Norris; Schr. Mary F. Sheppard; tonnage, 30; November 13, 1915; 1 year; \$45.00.
335. Hollinger, Harrison, Port Norris; Schr. Gratitude; tonnage, 28; April 20, 1916; 1 year; \$34.50.
216. Hunter, Aaron S., Haleyville; Slp. Frank V. Bateman; tonnage, 10; April 1, 1916; 1 year; \$15.00.
3. Hunter, William C., Haleyville; Schr. E. C. Vannaman; tonnage, 15; September 1, 1916; 1 year; \$22.50.
118. Husted, Quincy L., Newport; Schr. Amanda B. Lore; tonnage, 21; January 1, 1916, to September 30, 1916; \$31.50.
115. Iseman, Martin, Bivale; Slp. Melvin Bailey; tonnage, under; April 30, 1916; 1 year; \$10.00.
328. Jeffries, Robert L., Port Norris; Slp. J. S. Penney; tonnage, 14; April 27, 1916; 1 year; \$21.00.
532. Jenkins, William, Dividing Creek; Slp. Rhoda & Edith; tonnage, under; April 30, 1916; 1 year; \$10.00.
71. Johnson, Chas. F., Cedarville; Schr. Elsie M. Riechert; tonnage, 18; November 1, 1915; 1 year; \$27.00.

BOARD OF SHELL FISHERIES.

- 74, Johnson, Chas. W., Newport; Schr. Cashier; tonnage, 21; November 1, 1915; 1 year; \$31.50.
- 319, Johnson, Frank, Camden, Schr. Mary F. Howlett; tonnage, 27; March 31, 1916; 1 year; \$40.50.
- 228, Johnson, George W., Cape May; Slp. Christina; tonnage, 8; April 25, 1916; 1 year; \$12.00.
- 69, Joslin, Harrison, Newport; Schr. Paul C. Joslin; tonnage, 30; April 1, 1916; 1 year; \$45.00.
- 146, Ladow, Samuel H., Port Norris; Slp. Ellis Hand; tonnage, 13; April 29, 1916; 1 year; \$10.50.
- 588, Lake, Samuel C., Port Norris; Slp. Mall; tonnage, 13; April 1, 1916; 1 year; \$19.50.
- 285, Land, Geroges, Port Norris; Slp. Pilot; tonnage, under; April 1, 1916; 1 year; \$10.00.
- 129, Laws, Lake, Dividing Creek; Schr. Dawning Light; tonnage, 23; April 30, 1916; 1 year; \$34.50.
- 130, Leach, William, Greenwich; Schr. Philip Ford; tonnage, 32; April 9, 1916; 1 year; \$48.00.
- 223, Lee, Frank V., Leesburg; Slp. Mary C. Sharp; tonnage, 15; April 30, 1916; 1 year; \$22.50.
- 207, Lee, Harry M., Port Norris; Schr. David R. Lake; tonnage, 24; March 28, 1916; 1 year; \$36.00.
- 63, Lee, Maurice R., Port Norris; Schr. Reble and Ella; tonnage, 14; April 22, 1916; 1 year; \$21.00.
- 310, Lee, Samuel, Leesburg; Schr. Jennie Reeves; tonnage, 15; March 31, 1916; 1 year; \$22.50.
- 221, Lee, Steelman R., Leesburg; Schr. Chas. I. Covert; tonnage, 33; January 1, 1916; 1 year; \$49.50.
- 87, Lee, Uriah S., Leesburg; Schr. Three Sisters; tonnage, 23; April 20, 1916; 1 year; \$34.50.
- 166, Lilliston, Thomas, Dorchester; Schr. Wm. B. Stites; tonnage, 19; April 29, 1916; 1 year; \$28.50.
- 36, Lodge, Frank, Greenwich; Schr. Elvina E. Schoch; tonnage, 24; April 28, 1916; 1 year; \$36.00.
- 38, Lodge, James, Greenwich; Schr. Beatrice; tonnage, 22; April 28, 1916; 1 year; \$33.00.
- 21, Loper, Beriah, Dividing Creek; Schr. William Veale; tonnage, 35; January 2, 1916; 1 year; \$52.50.
- 18, Lore, U. S. Grant, Cedarville; Schr. Richard D. Lore; tonnage, 37; September 5, 1916; 1 year; \$55.50.
- 385, Ludlam, Henry, Pierces, Sloop Eva; tonnage, under; May 4, 1916; 1 year; \$10.00.
- 354, McDaniels, Howard, Leesburg; Slp. Wm. J. Bryan; tonnage, 13; April 1, 1916; 1 year; \$19.50.
- 23, Maurer, William, Keyport; Ga. Sc. Sabrina (Raritan Bay); tonnage, 14; July 21, 1915; 1 year; \$21.00.
- 378, Messick, Claude, Bivalve; Slp. C. & H. Elmer; tonnage, 11; April 12, 1916; 1 year; \$16.50.
- 204, Meerwald, Augustus J., Dennisville; Schr. Martha Meerwald; tonnage, 27; April 30, 1916; 1 year; \$40.50.
- 302, Morrison, Henry, Millville; Slp. Hattie W. Mills; tonnage, 14; March 31, 1916; 1 year; \$21.00.
- 233, Moore, Isaac, Dividing Creek; Slp. Sly; tonnage, under; April 29, 1916; 1 year; \$10.00.
- 99, Moore, S. Kelkey, Fairton; Schr. Robert Bould; tonnage, 30; April 24, 1916; 1 year; \$45.00.
- 279, Moore, Oscar, Port Norris; Schr. Jos. L. Mulford; tonnage, 34; April 30, 1916; 1 year; \$51.00.
- 116, Mulford, Elmer D., Bridgeton; Ga. Sc. Sarah M. Mulford; tonnage, 20; April 4, 1916; 1 year; \$30.00.
- 209, Mulford, Ernest L., Cedarville; Schr. Ephraim Mulford; tonnage, 33; March 28, 1916; 1 year; \$49.50.
- 377, Newcomb, Adrian B., Newport; Schr. James P. Neukirk; tonnage, 25; March 29, 1916; 1 year; \$37.50.

BOARD OF SHELL FISHERIES.

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281. Newcomb, B. O., Newport; Slp. Mary A. Bickley; tonnage, 13; April 1, 1916; 1 year; \$19.50.
439. Newcomb, Daniel L., Port Norris; Schr. Forest G. Howell; tonnage, 23; March 30, 1916; 1 year; \$34.50.
317. Newcomb, George, M.D., Newport; Schr. Tidal Wave; tonnage, 30; March 22, 1916; 1 year; \$45.00.
95. Newcomb, Lewis B., Cedarville; Schr. A. G. Mulford; tonnage, 15; October 8, 1916; 1 year; \$22.50.
26. Newcomb, Wm. F., Newport; Schr. Emma F. Newcomb; tonnage, 33; April 2, 1916; 1 year; \$49.50.
376. Nickerson, Harry E., Port Norris; Slp. Gracie; tonnage, 11; March 31, 1916; 1 year; \$16.50.
144. Nickerson, Henry C., Port Norris; Ga. Sc. Alma and Alvin; tonnage, 41; February 16, 1916; 1 year; \$61.50.
391. Nugent, Lorenzo, Millville; Slp. Fawn; tonnage, 12; March 28, 1916; 1 year; \$18.00.
300. Ogden, Columbus, Bridgeton; Ga. St. Samuel C. Jacoby; tonnage, 28; January 1, 1916; 1 year; \$42.00.
89. O'Hara, Harry, Port Norris; Schr. Frank & Theresa; tonnage, 25; April 1, 1916; 1 year; \$37.50.
76. Pepper, Jacob, Dividing Creek; Ga. Sc. Anna C. Terry; tonnage, 22; October 6, 1916; 1 year; \$33.00.
51. Peterson, Aaron, Port Norris; Slp. Pearl & Lelia; tonnage, 10; April 26, 1916; 1 year; \$15.00.
1. Peterson, Chas. S., Newport; Schr. C. W. Hand; tonnage, 36; April 30, 1916; 1 year; \$54.00.
255. Peterson, George C., Newport; Schr. Prize; tonnage, 28; September 19, 1916; 1 year; \$42.00.
167. Peterson, Dare, Port Norris; Slp. Nancy L. Cosler; tonnage, 14; April 1, 1916; 1 year; \$21.00.
318. Peterson, James, Port Norris; Schr. Nellie and Mary, tonnage, 21; April 3, 1916; 1 year; \$31.50.
200. Peterson, John C., Bridgeton; Schr. C. J. Peterson; tonnage, 37; April 3, 1916; 1 year; \$55.50.
316. Peterson, Wm. B., Port Norris; Schr. Anna M. Robbins; tonnage, 25; September 15, 1916; 1 year; \$37.50.
70. Pettit, Charles H., Bivalve; Slp. Sallie R. A.; tonnage, 14; April 1, 1916; 1 year; \$21.00.
314. Perry, William, Port Norris; Slp. Edison; tonnage, 14; April 28, 1916; 1 year; \$21.00.
145. Phillips, William B., Port Norris; Schr. Trio; tonnage, 18; April 28, 1916; 1 year; \$27.00.
296. Pickering, George, Greenwich; Schr. John Guyant; tonnage, 36; March 19, 1916; 1 year; \$54.00.
451. Pierce, John, Dorchester; Slp. Excel; tonnage, 8; April 23, 1916; 1 year; \$12.00.
189. Polhamus, Alfred, Leesburg; Slp. Lottie and Bertie; tonnage, under; May 1, 1916; 1 year; \$10.00.
117. Polhamus, William, Leesburg; Ga. Sc. Marcle; tonnage, under; April 28, 1916; 1 year; \$10.00.
388. Rahr, David W., Bricksboro; Slp. Helen Hurd; tonnage, 12; April 7, 1916; 1 year; \$18.00.
403. Randolph, Andrew, Port Norris; Schr. Walter H. Hinson; tonnage, 15; March 31, 1916; 1 year; \$22.50.
240. Reed, John, Port Norris; Schr. Wm. H. Berry; tonnage, 27; April 2, 1916; 1 year; \$40.50.
251. Rigglin, Charles, Port Norris; Slp. Starlight; tonnage, 18; April 1, 1916; 1 year; \$27.00.
9. Rigglin, Edward M., Port Norris; Schr. Rosa Lambert; tonnage, 25; April 3, 1916; 1 year; \$37.50.
304. Rigglin, Jacob, Port Norris; Schr. Sylvan Dell; tonnage, 14; April 2, 1916; 1 year; \$21.00.

- 125, Robbins, Edward C., Haleyville; Schr. Lizzie J. Robbins; tonnage, 16; April 7, 1916; 1 year; \$24.00.
- 2, Rigglin, William P., Port Norris; Ga. Sc. Addie S. Rigglin; tonnage, 29; April 1, 1916; 1 year; \$43.50.
- 237, Robbins, David, Jr., Port Norris; Schr. Mary J. Robbins; tonnage, 23; April 1, 1916; 1 year; \$34.50.
- 50, Robbins, George, Port Norris; Schr. Richard Robbins; tonnage, 26; April 1, 1916; 1 year; \$39.00.
- 172, Robbins, Harry, Port Norris; Schr. Addie B. Robbins; tonnage, 35; March 28, 1916; 1 year; \$52.50.
- 345, Robbins, Levi, Port Norris; Schr. Hattie B. Robbins; tonnage, 18; April 8, 1916; 1 year; \$27.00.
- 60, Robinson, Silas, Dividing Creek; Schr. Helen & Rhodella; tonnage, 33; April 28, 1916; 1 year; \$49.50.
- 113, Rogers, Maurice S., Camden; Schr. Emma C. Lore; tonnage, 18; April 28, 1916; 1 year; \$27.00.
- 210, Rowley, L. Bates, Port Norris; Schr. Daniel Sharp; tonnage, 20; April 18, 1916; 1 year; \$30.00.
- 103, Seibert, Fred, Cedarville; Slip. Marie; tonnage, under; May 1, 1916; 1 year; \$10.00.
- 224, Sharp, Albert, Haleyville; Schr. Elvina English; tonnage, 27; April 21, 1916; 1 year; \$40.50.
- 418, Sharp, John W., Leesburg; Slip. Laura G.; tonnage, 18; March 26, 1916; 1 year; \$19.50.
- 315, Sharp, John T., Port Norris; Schr. Rebecca T. Brunyate; tonnage, 21; March 22, 1916; 1 year; \$31.50.
- 59, Sharp, Zadok R., Jr., Dias Creek; Ga. Sc. Edna & Zadok; tonnage, 10; November 4, 1915; 1 year; \$15.00.
- 40, Sharp, Zadok, Sr., Leesburg; Schr. Virginia; tonnage, 31; March 28, 1916; 1 year; \$46.50.
- 468, Sharpless, John T., Millville; Schr. Mary C. Sharpless; tonnage, 21; March 30, 1916; 1 year; \$31.50.
- 416, Shaw, George, Dorchester; Schr. Ward B. Smith; tonnage, 19; March 26, 1916; 1 year; \$28.50.
- 185, Shaw, Howard, Leesburg; Slip. Helen F. Leaming; tonnage, 15; March 31, 1916; 1 year; \$22.50.
- 122, Shropshire, Edward, Haleyville; Schr. James H. Nixon; tonnage, 32; April 11, 1916; 1 year; \$48.00.
- 272, Shull, Burton, Dividing Creek; Schr. May Bateman; tonnage, 16; March 27, 1916; 1 year; \$24.00.
- 174, Shull, John L., Newport; Schr. Annie A. Crosswell; tonnage, 40; April 23, 1916; 1 year; \$60.00.
- 160, Shull, Roscoe, Port Norris; Ga. Sc. Luther Bateman; tonnage, 34; April 1, 1916; 1 year; \$51.00.
- 459, Smith, A. C., Leesburg; Schr. Seaman's Bride; tonnage, 28; October 7, 1916; 1 year; \$42.00.
- 259, Sockwell, Herbert, Port Norris; Ga. Sc. Lena G. Bateman; tonnage, 14; October 26, 1916; 1 year; \$21.00.
- 215, Smith, Henry C., Newport; Schr. Robert T. Lore; tonnage, 33; March 22, 1916; 1 year; \$49.50.
- 290, Spencer, Elmer, Newport; Slip. Blackbird; tonnage, under; March 28, 1916; 1 year; \$10.00.
- 214, Stites, Gilbert, Dragston; Schr. John Busby; tonnage, 12; March 25, 1916; 1 year; \$18.00.
- 320, Stites, Nathan, Millville; Schr. Perseverance; tonnage, 21; March 25, 1916; 1 year; \$31.50.
- 91, Sutter, John, Port Norris; Schr. Effie E. Mace; tonnage, 10; April 1, 1916; 1 year; \$15.00.
- 77, Sutter, Jacob, Port Norris; Slip. J. Gordon; tonnage, 10; April 28, 1916; 1 year; \$15.00.
- 119, Sutter, Harry, Port Norris; Slip. Mary L. Robbins; tonnage, 15; March 31, 1916; 1 year; \$22.50.

357. Sutter, William, Port Norris; Slp. Maude M. Robbins; tonnage, 14; April 5, 1916; 1 year; \$21.00.
30. Sutton, Clarence M., Bridgeton; Schr. John S. Myers; tonnage, 25; March 19, 1916; 1 year; \$37.50.
283. Sutton, Ernest, Bridgeton; Schr. Walter M. Johnson; tonnage, 25; March 26, 1916; 1 year; \$37.50.
8. Sutton, Harry, Leesburg; Schr. Lucy and Willie; tonnage, 17; April 1, 1916; 1 year; \$25.50.
101. Swank, David, Bivalve; Slp. Elva M. Robbins; tonnage, 7; April 1, 1916; 1 year; \$10.50.
58. Sweeney, William J., Port Norris; Slp. Mary Alice; tonnage, 13; March 31, 1916; 1 year; \$19.50.
29. Tarburton, Elmer E. Greenwich; Schr. Neil Johnson; tonnage, 39; April 30, 1916; 1 year; \$58.50.
406. Taylor, D. O., Port Norris; Slp. H. H. Mulford; tonnage, 16; April 1, 1916; 1 year; \$24.00.
186. Toohy, John, Camden; Schr. William E. James; tonnage, 42; April 20, 1916; 1 year; \$68.00.
65. Townsend, Stacy, Leesburg; Slp. Claude; tonnage, 11; April 28, 1916; 1 year; \$16.50.
269. Tonsor, Charles, Delmont; Slp. Jennie M. Chance; tonnage, 14; May 1, 1916; 1 year; \$21.00.
288. Turner, Lehman, Dividing Creek; Schr. Hattie E. Johnson; tonnage, 29; April 29, 1916; 1 year; \$48.50.
134. Turner, Chas., Newport; Schr. Phoebe B. Townsend; tonnage, 26; March 22, 1916; 1 year; \$39.00.
94. Tweed, John, Greenwich; Schr. Anna M. Frome; tonnage, 45; April 25, 1916; 1 year; \$67.50.
33. Vail, William A., Port Norris; Schr. Thos. H. Robbins; tonnage, 28; October 25, 1916; 1 year; \$42.00.
436. Van Vliet, William, Newport; Slp. James H. Turner; tonnage, 10; April 1, 1916; 1 year; \$15.00.
86. Ware, Sheppard S., Newport; Ga. Sc. R. D. Sheppard; tonnage, 34; October 22, 1916; 1 year; \$51.00.
100. Warren, Harry, Bridgeton; Ga. Sc. George S. Crepps; tonnage, 43; November 23, 1915; 1 year; \$64.50.
340. Wallen, David, Fairton; Schr. A. E. Whitaker; tonnage, 20; March 30, 1916; 1 year; \$30.00.
211. Weldon, William H., Newport; Schr. Geo. W. Crist; tonnage, 21; April 1, 1916; 1 year; \$31.50.
92. Westcott, Alfred L., Fairton; Schr. John H. Orr; tonnage, 27; April 20, 1916; 1 year; \$40.50.
203. Whilden, Somers H., Mauricetown; Schr. Anna M. Newcomb; tonnage, 24; March 28, 1916; \$36.00.
48. Williams, Whitefield, Hellserville; Schr. Sarah T. Sharp; tonnage, 17; April 29, 1916; 1 year; \$25.50.
112. Windforr, Arthur, Bivalve; Slp. Thelma; tonnage, 13; April 28, 1916; 1 year; \$19.50.

BOAT LICENSES—RARITAN BAY.

6. Hammer, James L., Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.
7. Hammer, James L., Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.
8. Hammer, James L., Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.
32. Maurer, William, Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.
20. Mason, John W., Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.
19. Post, Russell B., Keyport; Ga. Sc. L. J. Callanan; tonnage, 7; July 21, 1916; 1 year; \$10.50.
37. Woolley, William E., Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.

38. Woolley, William E., Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.
39. Woolley, William E., Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.
40. Woolley, William E., Keyport; tonging skiff; tonnage, under; July 21, 1916; 1 year; \$5.00.
41. Woolley, William E., Keyport; Ga. Sc. Alonzo E. Smith; tonnage, 18; July 21, 1916; 1 year; \$27.00.

OYSTER BED LEASES—DEPARTMENT OF THE MAURICE RIVER COVE.

*Indicates a debit or credit owing to lease being issued on estimated area, year 1915.

- Adams, J. Wesley, Port Norris; ground No. 1; acreage, 51; *\$24.00; June 20, 1916; 1 year; Sec. B, 174-226; Sec. C, 68-154.
- Adams & Cobb, Port Norris; ground No. 2; acreage, 36; \$18.00; June 20, 1916; 1 year; Sec. D, 495.
- Adams & Nicholson, Port Norris; ground No. 3; acreage, 24; \$12.00; June 20, 1916; 1 year; Sec. C, 196.
- Allen, Edward H., Bivalve; ground No. 5; acreage, 40; \$20.00; June 20, 1916; 1 year; Sec. B, 228-231; Sec. C, 316.
- Anderson & Messick, Bivalve; ground No. 4; acreage, 28; \$14.00; June 20, 1916; 1 year; Sec. C, 610.
- Bateman, Morton, Port Norris; ground No. 24; acreage, 186; *\$99.50; June 20, 1916; 1 year; Sec. A, 162; Sec. B, 104-158; Sec. C, 632; Sec. D, 148-311-481.
- Bateman, Luther, Newport; ground No. 30; acreage, 467; *\$291.50; June 20, 1916; 1 year; Sec. A, 264; Sec. B, 260; Sec. C, 459-447-264-265-266-73-451-534-843-354-556-627; Sec. D, 575-544.
- Bateman, Moses and Claude, Mauricetown; ground No. 21; acreage, 34; \$17.00; June 20, 1916; 1 year; Sec. A, 281; Sec. C, 548-139; Sec. D, 266.
- Bateman, J. Roberts, Mauricetown; ground No. 23; acreage, 127; *\$81.00; June 20, 1916; 1 year; Sec. A, 279; Sec. C, 114-516-403.
- Bateman & Swing, Fairton; ground No. 28; acreage, 9; \$5.00; June 20, 1916; 1 year; Sec. D, 77.
- Bateman & Gandy, Cedarville; ground No. 22; acreage, 18; \$9.00; June 20, 1916; 1 year; Sec. D, 360.
- Bateman, Rebecca, Est., Newport; ground No. 32; acreage, 54; \$27.00; June 20, 1916; 1 year; Sec. C, 72-267; Sec. D, 112.
- Bateman & Weldon, Newport; ground No. 31; acreage, 93; \$46.50; June 20, 1916; 1 year; Sec. A, 11; Sec. B, 251; Sec. C, 238-239; Sec. D, 136-321.
- Bateman & Bateman, Cedarville; ground No. 29; acreage, 68; \$34.00; June 20, 1916; 1 year; Sec. C, 251-110-323.
- Bateman & Burt, Cedarville; ground No. 25; acreage, 214; \$107.00; June 20, 1916; 1 year; Sec. B, 242; Sec. C, 254-433-275-273; Sec. D, 450-502.
- Bateman, Diamant & Elmer, Cedarville; ground No. 26; acreage, 222; \$111.00; June 20, 1916; 1 year; Sec. C, 268-448-112-499-355-327-270; Sec. D, 158-426.
- Bateman & Emerson, Cedarville; ground No. 27; acreage, 172; *\$91.00; June 20, 1916; 1 year; Sec. A, 148; Sec. C, 585-166-167-493; Sec. D, 30-513-558.
- Batley & Peace, Port Norris; ground No. 46; acreage, 69; *\$40.00; June 20, 1916; 1 year; Sec. B, 248; Sec. D, 591.
- Baker, William, Haleyville; ground No. 14; acreage, 7; \$5.00; June 20, 1916; 1 year; Sec. A, 118.
- Bell, George C., Jr., Bivalve; ground No. 7; acreage, 15; \$7.50; November 10, 1915, to June 20, 1916; Sec. B, 94.
- Bell, George C., Newport; ground No. 10; acreage, 8; *\$5.00; June 20, 1916; 1 year; Sec. A, 179.
- Bell, George C., Jr., Bivalve; ground No. 12; acreage, 98; \$49.00; June 20, 1916; 1 year; Sec. B, 230-94; Sec. C, 531-271; Sec. D, 530-427.

BOARD OF SHELL FISHERIES.

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- Bell, George C., Sr., Newport; ground No. 11; acreage, 51; *\$29.50; June 20, 1916; 1 year; Sec. A, 242; Sec. B, 276; Sec. D, 310-402.
- Bell & Bell, Newport; ground No. 13; acreage, 15; \$7.50; June 20, 1916; 1 year; Sec. D, 436.
- Berry, Phillip & Chas., Port Norris; ground No. 47; acreage, 106; \$62.50; June 20, 1916; 1 year; Sec. B, 117; Sec. C, 209-370-501; Sec. D, 95.
- Berry, Wm. H., Port Norris; ground No. 48; acreage, 212; \$106.00; June 20, 1916; 1 year; Sec. A, 224-225; Sec. B, 246-241-245-160; Sec. C, 485-195-378-472; Sec. D, 244-223-210-179.
- Berry, Henry A., Port Norris; ground No. 50; acreage, 61; \$30.50; June 20, 1916; 1 year; Sec. A, 173; Sec. B, 90; Sec. C, 369-471.
- Berry, W. J. and H. A., Port Norris; ground No. 49; acreage, 47; \$23.50; June 20, 1916; 1 year; Sec. C, 509; Sec. D, 552.
- Berry, Stultz, Port Norris; ground No. 51; acreage, 275; *\$188.00; June 20, 1916; 1 year; Sec. A, 176-181-288; Sec. B, 213; Sec. C, 542-510-371-218-413; Sec. D, 145-481-508.
- Blackman & Blackman, Port Norris; ground No. 37; acreage, 226; *\$118.50; June 20, 1916; 1 year; Sec. B, 236; Sec. C, 342,340; Sec. D, 94,532-564.
- Blissard, Geo. M., Cedarville; ground No. 34; acreage, 22; \$11.00; June 20, 1916; 1 year; Sec. D, 473.
- Bornhorst, August, Port Norris; ground No. 38; acreage, 99; \$49.50; June 20, 1916; 1 year; Sec. B, 168; Sec. C, 302; Sec. D, 256-569.
- Bowker, Chas., Dividing Creek; ground No. 40; acreage, 31; \$15.50; June 20, 1916; 1 year; Sec. B, 201; Sec. D, 241.
- Bowker, Thos., Port Norris; ground No. 39; acreage, 49; *\$24.00; June 20, 1916; 1 year; Sec. A, 259; Sec. C, 363; Sec. D, 194-524.
- Bowker & Bowker, Dividing Creek; ground No. 41; acreage, 44; \$22.00; June 20, 1916; 1 year; Sec. B, 78; Sec. C, 364; Sec. D, 425.
- Bradford, Lucius E., Newport; ground No. 17; acreage, 62; \$31.00; June 20, 1916; 1 year; Sec. B, 247; Sec. D, 252.
- Bradford, Chas. L., Newport; ground No. 19; acreage, 173; \$86.50; June 20, 1916; 1 year; Sec. C, 590-434-134; Sec. D, 170-489-420-611.
- Bradford, Lemuel, Newport; ground No. 18; acreage, 173; \$86.50; June 20, 1916; 1 year; Sec. C, 70-71-480; Sec. D, 351-438-143-295-470.
- Bradford, Elwood, Newport; ground No. 18; acreage, 16; \$8.00; June 20, 1916; 1 year; Sec. C, 82.
- Bradford & Vannaman, Newport; ground No. 20; acreage, 31; \$15.50; June 20, 1916; 1 year; Sec. C, 274-179; Sec. D, 257.
- Brineshults & Mayhew, Cedarville; ground No. 36; acreage, 402; \$201.00; June 20, 1916; 1 year; Sec. B, 169-76-77-77-154; Sec. C, 283-324-455-456-458-594-79-80-81-535-558; Sec. D, 421-183-331-29.
- Buck, George H., Bridgeton; ground No. 53; acreage, 9; \$5.00; June 20, 1915; 1 year.
- Burnight & Stites, Newport; ground No. 43; acreage, 20; \$10.00; June 20, 1916; 1 year; Sec. C, 410.
- Cain, Ellis O., Port Norris; ground No. 100; acreage, 38; \$19.00; June 20, 1916; 1 year; Sec. A, 301; Sec. D, 96-277.
- Campbell, Clement L., Bridgeton; ground No. 80; acreage, 175; *\$90.00; June 20, 1916; 1 year; Sec. B, 280-256; Sec. C, 136-137-122-352-416-262; Sec. D, 366-562-578-75.
- Campbell, A. B., Newport; ground No. 73; acreage, 6; \$5.00; June 20, 1916; 1 year; Sec. D, 160.
- Campbell, Archie, Port Norris; ground No. 183; acreage, 10; \$5.00; April 17, 1916, to June 20, 1916, 2 months, 3 days; Sec. C, 10.
- Campbell Est., & Campbell, Newport; ground No. 74; acreage, 60; \$30.00; June 20, 1916; 1 year; Sec. C, 332-407; Sec. D, 153.
- Campbell, Campbell, Campbell & Campbell Est., Newport; ground No. 71; acreage, 62; \$31.00; June 20, 1916; 1 year; Sec. C, 598.
- Campbell Est., Campbell & Campbell, Newport; ground No. 76; acreage, 48; \$24.00; June 20, 1916; 1 year; Sec. D, 416-499.
- Campbell, Jas., Estate, Newport; ground No. 75; acreage, 175; \$87.50; June 20, 1916; 1 year; Sec. C, 637-328-406-635; Sec. D, 576-206-154.
- Campbell, Peter, Newport; ground No. 79; acreage, 15 (an increase only of ground 477); \$7.50; June 20, 1916; 1 year; Sec. C, 477 (area increased 15 acres).

- Campbell, James, Mauricetown; ground No. 72; acreage, 47; \$23.50; June 20, 1916; 1 year; Sec. C, 400-401-576.
- Campbell, Sheppard, Newport; ground No. 78; acreage, 70; \$35.00; June 20, 1916; 1 year; Sec. B, 14; Sec. D, 327-122.
- Campbell, Peter, Newport; ground No. 79; acreage, 175; *\$94.50; June 20, 1916; 1 year; Sec. A, 235; Sec. C, 280-337-281-477; Sec. D, 594-161-286-597.
- Campbell, Winfield, Bivalve; ground No. 69; acreage, 64; \$32.00; June 20, 1916; 1 year; Sec. B, 141-255; Sec. C, 541-58-32-10; Sec. D, 328.
- Campbell & Buzby, Port Norris; ground No. 61; acreage, 271; \$135.50; June 20, 1916; 1 year; Sec. B, 121-115; Sec. C, 208-315-313-144-121-111-208; Sec. D, 500-146-147-106.
- Campbell & Robbins, Port Norris; ground No. 77; acreage, 324; *\$164.00; June 20, 1916; 1 year; Sec. A, 121; Sec. B, 223; Sec. C, 446-605-246-247-249-533; Sec. D, 297-219-149.
- Chambers, Walter, Delmont; ground No. 105; acreage, 10; \$5.00; June 20, 1916; 1 year; Sec. B, 67.
- Chance, Eli W., Mauricetown; ground No. 86; acreage, 161; \$80.50; June 20, 1916; 1 year; Sec. A, 160-272-209-51-101-112-138; Sec. B, 224; Sec. C, 873-142.
- Chance & Chance, Mauricetown; ground No. 87; acreage, 10; \$5.00; June 20, 1916; 1 year; Sec. B, 206.
- Chew, William V., Port Norris; ground No. 97; acreage, 10; \$5.00; June 20, 1916; 1 year; Sec. B, 207.
- Chew, Bateman & Henry, Port Norris; ground No. 98; acreage, 33; \$16.50; June 20, 1916; 1 year; Sec. C, 202; Sec. D, 177.
- Chew, Bateman & Brandriff, Port Norris; ground No. 99; acreage, 41; *\$18.00; June 20, 1916; 1 year; Sec. D, 587.
- Clark, Joshua, Port Norris; ground No. 85; acreage, 48; \$24.00; June 20, 1916; 1 year; Sec. C, 360; Sec. D, 490.
- Clark, John and Howard, Port Norris; ground No. 84; acreage, 82; \$41.00; June 20, 1916; 1 year; Sec. A, 125; Sec. C, 549; Sec. D, 492-554.
- Compton & Erickson, Leesburg; ground No. 64; acreage, 12; *\$6.00; November 11, 1915, to June 20, 1916; Sec. D, 613.
- Compton & Erickson, Leesburg; ground No. 108; acreage, 187; *\$82.50; June 20, 1916; 1 year; Sec. A, 108; Sec. B, 20; Sec. C, 206-630; Sec. D, 586-606-613.
- Compton & Leb, Leesburg; ground No. 104; acreage, 34; *\$24.00; June 20, 1916; 1 year; Sec. A, 233; Sec. D, 603.
- Conahay & Campbell, Port Norris; ground No. 66; acreage, 27; \$13.50; June 20, 1916; 1 year; Sec. A, 89.
- Compton & Roe, Leesburg; ground No. 102; acreage, 47; \$23.50; June 20, 1916; 1 year; Sec. A, 215; Sec. D, 385.
- Conahay & Yates, Port Norris; ground No. 65; acreages, 32; \$16.00; June 20, 1916; 1 year; Sec. A, 290.
- Cook, E. J., Port Norris; ground No. 67; acreage, 157; \$81.00; June 20, 1916; 1 year; Sec. B, 112-165-240-210-211; Sec. C, 518-567-7-205-68-519; Sec. D, 441.
- Cosler, Lucius E., Newport; ground No. 92; acreage, 49; \$24.50; June 20, 1916; 1 year; Sec. B, 238; Sec. D, 151-218.
- Cosler, P. C. and M. R., Newport; ground No. 64; acreage, 28; \$14.00; June 20, 1916; 1 year; Sec. D, 278.
- Coster, Peter C., Newport; ground No. 90; acreage, 222; \$97.00; June 20, 1916; 1 year; Sec. C, 258-260-241; Sec. D, 574-71-110-290.
- Cosler & Gates, Newport; ground No. 89; acreage, 22; \$11.00; June 20, 1916; 1 year; Sec. C, 478; Sec. D, 99-78.
- Cosler & Husted, Newport; ground No. 88; acreage, 28; \$14.00; June 20, 1916; 1 year; Sec. C, 259.
- Cosler, Cosler, More & Ware, Newport; ground No. 91; acreage, 19; \$9.50; June 20, 1916; 1 year; Sec. C, 357; Sec. D, 72.
- Cosler, William W., Dividing Creek; ground No. 93; acreage, 16; \$8.00; June 20, 1916; 1 year; Sec. C, 480; Sec. D, 70.
- Covert & Lee, Leesburg; ground No. 108; acreage, 10; \$5.00; November 27, 1915, to June 20, 1916, 2 months, 10 days; Sec. D, 480.

- Covert & Lee, Leesburg; ground No. 101; acreage, 299; *\$153.00; June 20, 1916; 1 year; Sec. A, 111-248-197-100-131-137; Sec. B, 279-280; Sec. C, 312-320-582; Sec. D, 479-485.
- Cox, Champion H., Leesburg; ground No. 131; acreage, 25; \$12.50; April 10, 1916, to June 20, 1916; Sec. C, 223.
- Cox, Jonathan and Lilburn, Leesburg; ground No. 83; acreage, 38; \$19.00; June 20, 1916; 1 year; Sec. C, 83; Sec. D, 553.
- Cox, Champion & Lilburn, Leesburg; ground No. 82; acreage, 48; \$24.00; June 20, 1916; 1 year; Sec. A, 183-293.
- Crossley, Geo. B., Newport; ground No. 94; acreage, 42; \$21.00; June 20, 1916; 1 year; Sec. C, 495; Sec. D, 345.
- Crossley & Joslin, Newport; ground No. 95; acreage, 33; \$16.50; June 20, 1916; 1 year; Sec. D, 322-567.
- Cruise, Benj. B., Mauricetown; ground No. 96; acreage, 176; \$88.00; June 20, 1916; 1 year; Sec. A, 169; Sec. B, 6-7; Sec. C, 94-358-512; Sec. D, 335-516.
- Donnelly & Donnelly, Heislerville; ground No. 115; acreage, 145; \$72.50; June 20, 1916; 1 year; Sec. A, 105-284-158-164; Sec. D, 540.
- Earl, Earl & Earl, Port Norris; ground No. 119; acreage, 9; \$5.00; June 20, 1916; 1 year; Sec. B, 222.
- Earl & Stites, Port Norris; ground No. 117; acreage, 22; \$11.00; June 20, 1916; 1 year; Sec. C, 625.
- Evans, Evans & Evans, Millville; ground No. 118; acreage, 209; *\$106.50; June 20, 1916; 1 year; Sec. A, 273; Sec. B, 195; Sec. D, 882-583.
- Fauver, William, Heislerville; ground No. 128; acreage 8; \$5.00; June 20, 1916; 1 year; Sec. C, 565.
- Fagan, Raymond, Est., Port Norris; ground No. 127; acreage, 66; \$32.50; June 20, 1916; 1 year; Sec. B, 196; Sec. D, 565-592.
- Ferguson, Leo F., Leesburg; ground No. 121; acreage, 38; \$19.00; June 20, 1916; 1 year; Sec. B, 9; Sec. D, 307.
- Ferguson, Argus S., Est., Leesburg; ground No. 125; acreage, 23; \$11.50; June 20, 1916; 1 year; Sec. C, 626.
- Fidler, Frank, Dennisville; ground No. 122; acreage, 39; \$19.50; June 20, 1916; 1 year; Sec. A, 24.
- Fithian, Samuel P., Bridgeton; ground No. 124; acreage, 11; \$5.50; June 20, 1916; 1 year; Sec. C, 96.
- Fithian & Minch, Bridgeton; ground No. 123; acreage, 369; \$184.50; June 20, 1916; 1 year; Sec. A, 153; Sec. B, 75; Sec. C, 465-277-482-234-118-126; Sec. D, 150-287-518.
- Foster, W. Linwood, Delmont; ground No. 129; acreage, 11; \$5.50; June 20, 1916; 1 year; Sec. B, 15.
- Fowler & Morris, Port Norris; ground No. 126; acreage, 625; \$312.50; June 20, 1916; 1 year; Sec. A, 120-157; Sec. B, 100-272-63-101-178; Sec. C, 835-450-498-449-269; Sec. D, 74-472.
- Garrison, Austin, Bridgeton; ground No. 137; acreage, 8; \$5.00; June 20, 1916; 1 year; Sec. D, 41.
- Garrison, Richard, Port Norris; ground No. 140; acreage, 81; \$40.50; June 20, 1916; 1 year; Sec. A, 69-171; Sec. B, 182-19; Sec. C, 362.
- Garrison, Daniel C., Heislerville; ground No. 134; acreage, 98; \$49.00; June 20, 1916; 1 year; Sec. A, 178; Sec. B, 217; Sec. C, 301-508.
- Garrison, Frank L., Dividing Creek; ground No. 141; acreage, 12; \$6.00; June 20, 1916; 1 year; Sec. C, 19.
- Garrison & Sharp, Bridgeton or Vineland; ground No. 138; acreage, 18; \$6.50; June 20, 1916; 1 year; Sec. A, 113.
- Gandy, Miles, Cedarville; ground No. 136; acreage, 226; \$113.00; June 20, 1916; 1 year; Sec. C, 462-464-268-282-279; Sec. D, 422-173-174-283.
- Gandy & Hillman, Dennisville; ground No. 144; acreage, 10; \$5.00; June 20, 1916; 1 year; Sec. D, 67.
- Gandy & Van Gilder, Dennisville; ground No. 142; acreage, 120; \$60.00; June 20, 1916; 1 year; Sec. A, 32-156; Sec. D, 104-292.
- Gaskill, George S., Port Norris; ground No. 135; acreage, 62; \$31.00; June 20, 1916; 1 year; Sec. C, 295; Sec. D, 137-433-550.

- Gaskill, John, Newport; ground No. 139; acreage, 360; \$180.00; June 20, 1916; 1 year; Sec. A, 52-333-213; Sec. B, 267; Sec. C, 611-634-444-476-592; Sec. D, 184-294-486.
- Green, Socrates, Port Norris; ground No. 143; acreage, 20; \$10.00; June 20, 1916; 1 year; Sec. B, 216.
- Hager, Sherman, Pennsgrove; ground No. 152; acreage, 58; \$29.00; June 20, 1916; 1 year; Sec. A, 84.
- Haley, Clarence, Mauricetown; ground No. 150; acreage, 34; \$17.00; June 20, 1916; 1 year; Sec. B, 156.
- Hagemann, A. C. C., Merchantville; ground No. 176; acreage, 328; *\$162.00; June 20, 1916; 1 year; Sec. A, 141-136-161; Sec. B, 99-127; Sec. C, 524-88-296; Sec. D, 568-429-193-208-386.
- Hand, Constant W., Port Norris; ground No. 165; acreage, 291; \$145.50; June 20, 1916; 1 year; Sec. B, 116-58-270; Sec. C, 310-553-418; Sec. D, 456-378-315-494-35-175-176-142.
- Hand, Benj. Berry, Port Norris; ground No. 163; acreage, 92; \$46.00; June 20, 1916; 1 year; Sec. B, 214-122; Sec. C, 488.
- Hand, Berry & Berry, Port Norris; ground No. 162; acreage, 159; \$79.50; June 20, 1916; 1 year; Sec. A, 139; Sec. C, 23-368; Sec. D, 157-168.
- Hand & Ladow, Port Norris; ground No. 181; acreage, 27; \$13.50; June 20, 1916; 1 year; Sec. C, 78; Sec. D, 526.
- Hand & Campbell, Port Norris; ground No. 164; acreage, 222; *\$113.50; June 20, 1916; 1 year; Sec. B, 267; Sec. C, 400-421; Sec. D, 817-428-505-190-261-261.
- Hand, Harrison, Port Norris; ground No. 158; acreage, 33; \$16.50; June 20, 1916; 1 year; Sec. B, 118; Sec. C, 213-578.
- Hand & Riffin, Port Norris; ground No. 180; acreage, 16; \$8.00; June 20, 1916; 1 year; Sec. D, 484.
- Hand & Randolph, Port Norris; ground No. 157; acreage, 73; *\$36.00; June 20, 1916; 1 year; Sec. A, 276; Sec. B, 62; Sec. D, 581.
- Hand & Joslin, Newport; ground No. 160; acreage, 15; \$7.50; June 20, 1916; 1 year; Sec. C, 356.
- Hand & Berry, Port Norris; ground No. 161; acreage, 17; \$8.50; June 20, 1916; 1 year; Sec. C, 406.
- Hanners, McClellan, Newport; ground No. 168; acreage, 39; \$19.50; June 20, 1916; 1 year; Sec. D, 16-163-377.
- Harris, Rebecca S., Leesburg; ground No. 154; acreage, 56; \$28.00; June 20, 1916; 1 year; Sec. B, 98.
- Harrington, Gerald, Port Norris; ground No. 173; acreage, 6; \$5.00; June 20, 1916; 1 year; Sec. C, 155.
- Henderson, Lafayette, Leesburg; ground No. 151; acreage, 64; \$32.00; June 20, 1916; 1 year; Sec. C, 245; Sec. D, 355.
- Hettinger, H. A., Bridgeton; ground No. 172; acreage, 214; *\$148.50; June 20, 1916; 1 year; Sec. A, 260; Sec. C, 248; Sec. D, 521-610.
- Hiles, Hiles & Sutter, Haleyville; ground No. 178; acreage, 22; \$11.00; June 20, 1916; 1 year; Sec. D, 560.
- Hiles & Hiles, Haleyville; ground No. 177; acreage, 25; \$12.50; June 20, 1916; 1 year; Sec. B, 249; Sec. C, 602-233.
- Hinson & Bateman, Mauricetown; ground No. 155; acreage, 326; *\$166.00; June 20, 1916; 1 year; Sec. A, 262-180; Sec. C, 186-242-520-432-97-90-305-224-367-431; Sec. D, 131-130.
- Hinson, Walter H., Port Norris; ground No. 156; acreage, 31; \$15.50; June 20, 1916; 1 year; Sec. A, 269; Sec. C, 314-380.
- Hoffman, Silas, Port Norris; ground No. 159; acreage, 10; \$5.00; June 20, 1916; 1 year; Sec. C, 43.
- Holmes, Edward, Pierces; ground No. 149; acreage, 32; \$16.00; June 20, 1916; 1 year; Sec. A, 184.
- Hollinger, Harrison, Port Norris; ground No. 174; acreage, 118; *\$58.50; June 20, 1916; 1 year; Sec. A, 207-302; Sec. B, 218-97; Sec. C, 63-214-236; Sec. D, 106.
- Hollinger, George, Port Norris; ground No. 179; acreage, 26; \$13.00; June 20, 1916; 1 year; Sec. B, 200; Sec. C, 292.

- Howlett, John J., Camden; ground No. 153; acreage, 188; *\$94.50; June 20, 1916; 1 year; Sec. C, 503-514-486; Sec. D, 314-542-523.
- Hollinger & Bradford, Port Norris; ground No. 175; acreage, 30; \$15.00; June 20, 1916; 1 year; Sec. D, 235.
- Hunter, Aaron S., Haleyville; ground No. 170; acreage, 27; \$13.50; June 20, 1916; 1 year; Sec. A, 204-206; Sec. D, 235.
- Hunter, William C., Haleyville; ground No. 169; acreage, 38; \$19.00; June 20, 1916; 1 year; Sec. B, 205-212; Sec. D, 18-15.
- Hunter & Hunter, Haleyville; ground No. 171; acreage, 74; *\$34.00; June 20, 1916; 1 year; Sec. A, 151; Sec. B, 66; Sec. C, 359; Sec. D, 155-358.
- Husted, Howard S., Port Norris; ground No. 167; acreage, 70; \$35.00; June 20, 1916; 1 year; Sec. C, 108-412; Sec. D, 163-464.
- Husted & Campbell, Port Norris; ground No. 166; acreage, 38; \$19.00; June 20, 1916; 1 year; Sec. D, 341-528.
- Isard, Somers H., Rio Grande; ground No. 187; acreage, 18; \$9.00; June 20, 1916; 1 year; Sec. D, 195.
- Jeffries, Robt. L., Port Norris; ground No. 190; acreage, 156; *\$79.50; June 20, 1916; 1 year; Sec. B, 212-244; Sec. C, 231-376-532; Sec. D, 501-563.
- Jenkins, William, Dividing Creek; ground No. 191; acreage, 11; \$5.50; June 20, 1916; 1 year; Sec. D, 280-19.
- Johnson, Chas. W., Newport; ground No. 193; acreage, 73; \$36.50; June 20, 1916; 1 year; Sec. B, 252; Sec. D, 263.
- Johnson, Chas. F., Cedarville; ground No. 192; acreage, 198; *\$104.00; June 20, 1916; 1 year; Sec. A, 147; Sec. C, 93-285-454; Sec. D, 340-496.
- Joslin, Benj. S., Newport; ground No. 197; acreage, 26; \$13.00; June 20, 1916; 1 year; Sec. D, 97-98.
- Joslin & Johnson, Newport; ground No. 198; acreage, 12; \$6.00; June 20, 1916; 1 year; Sec. C, 639.
- Joslin, Mulford & Mulford, Newport; ground No. 196; acreage, 60; \$30.00; June 20, 1916; 1 year; Sec. C, 593-240-411; Sec. D, 171.
- Johnson & Johnson, Greenwich; ground No. 199; acreage, 122; *\$72.00; June 20, 1916; 1 year; Sec. C, 577; Sec. D, 604.
- Ladow, Sylvanus A., Dividing Creek; ground No. 221; acreage, 14; \$7.60; June 20, 1916; 1 year; Sec. D, 11.
- Lake, J. Hammitt, Port Norris; ground No. 217; acreage, 156; \$78.00; June 20, 1916; 1 year; Sec. B, 92; Sec. C, 171-606-84-623-561-109.
- Lake, J. Hammitt, Port Norris; ground No. 208; acreage, 9; \$5.00; June 20, 1916; 1 year; Sec. D, 308.
- Lake, Samuel C., Port Norris; ground No. 220; acreage, 115; *\$66.00; June 20, 1916; 1 year; Sec. B, 91; Sec. C, 595-638; Sec. D, 332.
- Lake, Sarah E., Port Norris; ground No. 216; acreage, 89; \$44.50; June 20, 1916; 1 year; Sec. A, 174; Sec. C, 187; Sec. D, 114-423.
- Lake & Miller, Port Norris; ground No. 222; acreage, 16; \$8.00; June 20, 1916; 1 year; Sec. A, 92.
- Land, Gerges, Port Norris; ground No. 218; acreage, 12; \$6.00; June 20, 1916; 1 year; Sec. A, 267.
- Lee, Addie, Leesburg; ground No. 215; acreage, 14; \$7.00; June 20, 1916; 1 year; Sec. A, 192.
- Lee, Frank V., Leesburg; ground No. 213; acreage, 6; \$5.00; June 20, 1916; 1 year; Sec. A, 132.
- Lee, Harry M., Port Norris; ground No. 211; acreage, 139; \$69.50; June 20, 1916; 1 year; Sec. B, 234; Sec. C, 143-138-428; Sec. D, 144-381.
- Lee, Maurice R., Port Norris; ground No. 212; acreage, 46; \$23.00; June 20, 1916; 1 year; Sec. A, 60; Sec. B, 134; Sec. D, 262-245.
- Lee, Samuel, Leesburg; ground No. 210; acreage, 16; \$8.00; June 20, 1916; 1 year; Sec. D, 424.
- Lee & Newcomb, Port Norris; ground No. 214; acreage, 10; \$5.00; June 20, 1916; 1 year; Sec. B, 274.
- Loper, George S., Dividing Creek; ground No. 219; acreage, 6; \$5.00; June 20, 1916; 1 year; Sec. D, 397.

- Lore, Addie, Newport; ground No. 209; acreage, 81; \$40.50; June 20, 1916; 1 year; Sec. D, 296.
- Lore, Louvisa, Millville; ground No. 207; acreage, 6; \$5.00; June 20, 1916; 1 year; Sec. D, 166.
- Lore & Jolley, Atlantic City; ground No. 206; acreage, 136; \$68.00; June 20, 1916; 1 year; Sec. B, 29; Sec. C, 319-429-441; Sec. D, 128-166-152.
- Lore, Lore & Lore, Cedarville; ground No. 205; acreage, 143; \$71.50; June 20, 1916; 1 year; Sec. B, 32; Sec. C, 396; Sec. D, 59-60-444-491.
- McDaniels, John, Port Norris; ground No. 227; acreage, 17; \$8.50; June 20, 1916; 1 year; Sec. C, 2-4.
- McDaniels Est. & Daniels, Port Norris; ground No. 242; acreage, 18; \$6.50; June 20, 1916; 1 year; Sec. D, 442.
- McDaniels & Rowley, Port Norris; ground No. 229; acreage, 41; *\$25.00; June 20, 1916; 1 year; Sec. C, 165; Sec. D, 595.
- McDaniels & Newcomb, Leesburg; ground No. 240; acreage, 37; \$18.50; June 20, 1916; 1 year; Sec. C, 480; Sec. D, 299.
- Meerwald, Augustus J., Dennisville; ground No. 239; acreage, 188; \$94.00; June 20, 1916; 1 year; Sec. A, 31-239.
- Messick & Iseman, Bivalve; ground No. 228; acreage, 21; \$10.50; June 20, 1916; 1 year; Sec. C, 293.
- More, Robert, Bridgeton; ground No. 231; acreage, 208; \$104.00; June 20, 1916; 1 year; Sec. A, 150; Sec. C, 115-484-521; Sec. D, 187-329.
- Moore, Isaac L., Dividing Creek; ground No. 233; acreage, 10; \$5.00; June 20, 1916; 1 year; Sec. D, 259.
- Moore, Samuel K., Fairton; ground No. 230; acreage, 48; \$24.00; June 20, 1916; 1 year; Sec. D, 305.
- Moore, Oscar, Port Norris; ground No. 234; acreage, 14; \$7.00; June 20, 1916; 1 year; Sec. B, 152.
- Moore, Oscar & Newcomb, J. S., Port Norris; ground No. 232; acreage, 10; \$5.00; June 20, 1916; 1 year; Sec. B, 277.
- Moore, Newcomb & Newcomb, Port Norris; ground No. 235; acreage, 82; \$16.00; June 20, 1916; 1 year; Sec. B, 275.
- Mulford, Ephraim, Est., Bridgeton; ground No. 238; acreage, 14; \$7.00; June 20, 1916; 1 year; Sec. B, 1; Sec. C, 124.
- Mulford & Mulford, Bridgeton; ground No. 236; acreage, 602; *\$298.00; June 20, 1916; 1 year; Sec. A, 236-99; Sec. B, 73-130; Sec. C, 117-120-331-334-346-529-125-269-333-14-177-174; Sec. D, 50-341-606-390-63-55.
- Mulford, Mulford & Mulford Estate, Bridgeton; ground No. 237; acreage, 283; \$141.50; June 20, 1916; 1 year; Sec. C, 388-463-130-131-330; Sec. D, 181.
- Newcomb, Adrian B., Newport; ground No. 254; acreage, 153; \$76.50; June 20, 1916; 1 year; Sec. B, 261; Sec. C, 414-589-256-291-341; Sec. D, 538-169.
- Newcomb, B. O., Newport; ground No. 265; acreage, 25; *\$16.00; June 20, 1916; 1 year; Sec. C, 601.
- Newcomb, Lewis B., Cedarville; ground No. 256; acreage, 66; \$33.00; June 20, 1916; 1 year; Sec. C, 87; Sec. D, 45-65-337-102.
- Newcomb, G. M. D., & Stites, H., Newport; ground No. 264; acreage, 167; \$33.50; June 20, 1916; 1 year; Sec. C, 243-318-422; Sec. D, 352.
- Newcomb, Myra H., Port Norris; ground No. 257; acreage, 61; \$30.50; June 20, 1916; 1 year; Sec. B, 114-171; Sec. C, 443; Sec. D, 135.
- Newcomb, Olin W., Port Norris; ground No. 253; acreage, 17; \$8.50; June 20, 1916; 1 year; Sec. C, 135-141.
- Newcomb, William B., Newport; ground No. 255; acreage, 42; *\$17.00; June 20, 1916; 1 year; Sec. C, 426-425.
- Newcomb, Peter F., Newport; ground No. 258; acreage, 205; \$102.50; June 20, 1916; 1 year; Sec. C, 133-297-427; Sec. D, 463-162-189-343.
- Newcomb, Josiah S. and Daniel L., Port Norris; ground No. 249; acreage, 165; *\$89.50; June 20, 1916; 1 year; Sec. A, 308; Sec. B, 163-135; Sec. C, 551; Sec. D, 313-178-585.
- Newcomb & Yates, Port Norris; ground No. 252; acreage, 19; \$9.50; June 20, 1916; 1 year; Sec. D, 449.

BOARD OF SHELL FISHERIES.

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- Newcomb, Moore & Moore, Port Norris; ground No. 251; acreage, 47; \$23.50; June 20, 1916; 1 year; Sec. D, 582.
- Newcomb, Newcomb & Moore, Port Norris; ground No. 250; acreage, 102; *\$89.50; June 20, 1916; 1 year; Sec. D, 507-598-448.
- Nickelson, Henry C., Port Norris; ground No. 260; acreage, 114; \$57.00; June 20, 1916; 1 year; Sec. C, 67; Sec. D, 510-555.
- Nickerson & Sheppard, Port Norris; ground No. 262; acreage, 19; *\$13.00; June 20, 1916; 1 year; Sec. D, 571.
- Orr, Mark L., Dividing Creek; ground No. 269; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. D, 118.
- Pashley, Charles, Dividing Creek; ground No. 272; acreage, 24; \$12.00; June 20, 1916; 1 year; Sec. D, 367.
- Peace, William M., Port Norris; ground No. 273; acreage, 31; \$15.50; June 20, 1916; 1 year; Sec. C, 189; Sec. D, 202.
- Peterson, George C., Newport; ground No. 277; acreage, 117; \$58.50; June 20, 1916; 1 year; Sec. C, 338-588; Sec. D, 520-324-73.
- Peterson, John C., Bridgeton; ground No. 278; acreage, 256; *\$133.00; June 20, 1916; 1 year; Sec. C, 517; Sec. D, 28-230-308-512-581-455-618.
- Peterson, Wm. B., Port Norris; ground No. 132; acreage, 30; \$15.00; April 15, 1916, to June 20, 1916, 2 months, 5 days; extension in area, Sec. B, 235.
- Peterson, Wm. B., Port Norris; ground No. 279; acreage, 179; *\$88.00; June 20, 1916; 1 year; Sec. B, 235-109-124; Sec. C, 307-149-217-308.
- Peterson & Bateman, Port Norris; ground No. 274; acreage, 158; \$79.00; June 20, 1916; 1 year; Sec. B, 107-108; Sec. C, 304-57-188-192; Sec. D, 225-120-201-212.
- Peterson & Peterson, Port Norris; ground No. 275; acreage, 42; \$21.00; June 20, 1916; 1 year; Sec. D, 394.
- Petit, Charles, Bivalve; ground No. 280; acreage, 19; \$9.50; June 20, 1916; 1 year; Sec. B, 225; Sec. C, 31.
- Pepper & Pepper, Port Norris; ground No. 282; acreage, 123; *\$64.00; June 20, 1916; 1 year; Sec. B, 111-221; Sec. D, 478-188-189-140-34.
- Pierce, Pierce & Pierce, Dorchester; ground No. 281; acreage, 82; \$41.00; June 20, 1916; 1 year; Sec. A, 34-233; Sec. C, 351-345-584; Sec. D, 547.
- Polhamus, Alfred and Oscar, Leesburg; ground No. 270; acreage, 22; \$11.00; June 20, 1916; 1 year; Sec. C, 204.
- Rahr, David W., Bricksboro; ground No. 308; acreage, 18; \$9.00; June 20, 1916; 1 year; Sec. A, 211.
- Randolph, Andrew, Port Norris; ground No. 306; acreage, 25; \$12.50; June 20, 1916; 1 year; Sec. A, 222; Sec. C, 212.
- Randolph & Adams, Leesburg; ground No. 307; acreage, 9; \$5.00; June 20, 1916; 1 year; Sec. D, 482.
- Riggin, Chas. M., Port Norris; ground No. 317; acreage, 85; \$42.50; June 20, 1916; 1 year; Sec. B, 193; Sec. C, 506; Sec. D, 291.
- Riggin, Chas. M. and Edw. M., Port Norris; ground No. 315; acreage, 84; \$17.00; June 20, 1916; 1 year; Sec. C, 572.
- Riggin, Edward M., Port Norris; ground No. 316; acreage, 95; \$47.50; June 20, 1916; 1 year; Sec. A, 221; Sec. C, 321; Sec. D, 493-293.
- Riggin Est., Riggin, Chas. M., Port Norris; ground No. 314; acreage, 41; \$20.50; June 20, 1916; 1 year; Sec. C, 394; Sec. D, 61.
- Riggin, Riggin & Riggin Est., Port Norris; ground No. 312; acreage, 83; \$41.50; June 20, 1916; 1 year; Sec. D, 434.
- Riggin, Walter C., Est., Port Norris; ground No. 313; acreage, 176; *\$108.00; June 20, 1916; 1 year; Sec. A, 191; Sec. C, 573; Sec. D, 508-608-289.
- Robbins, Harry, David, Leon and Alvin, Port Norris; ground No. 288; acreage, 302; *\$151.50; June 20, 1916; 1 year; Sec. A, 175; Sec. B, 68-72-110; Sec. C, 417-481-182-306-438-473-487-54-55-56-197; Sec. D, 349-514-566.
- Robbins, Robbins & Robbins, Port Norris; ground No. 289; acreage, 15; \$7.50; June 20, 1916; 1 year; Sec. C, 24.
- Robbins & Reed, Port Norris; ground No. 293; acreage, 249; *\$125.00; June 20, 1916; 1 year; Sec. A, 203-123; Sec. B, 159; Sec. C, 502-547-76-250; Sec. D, 549-115-270-302-519.

- Robbins, Sheppard, Port Norris; ground No. 302; acreage, 18; \$9.00; June 20, 1916; 1 year; Sec. C, 402.
- Robbins, Clarence M., Port Norris; ground No. 290; acreage, 91; \$45.50; June 20, 1916; 1 year; Sec. A, 294; Sec. B, 82; Sec. C, 286-390; Sec. D, 68-498.
- Robbins, David, Jr., Port Norris; ground No. 291; acreage, 90; \$45.00; June 20, 1916; 1 year; Sec. A, 02; Sec. B, 176; Sec. C, 288-325-294; Sec. D, 272-108.
- Robbins & O'Neill, Port Norris; ground No. 292; acreage, 36; \$18.00; June 20, 1916; 1 year; Sec. A, 58; Sec. C, 515.
- Robbins, Clarence M. and David, Jr., Port Norris; ground No. 300; acreage, 304; \$155.00; June 20, 1916; 1 year; Sec. A, 59; Sec. B, 89; Sec. C, 200-511-468-196-199; Sec. D, 435-596-556-138.
- Robbins, David, Sr., Port Norris; ground No. 298; acreage, 43; \$21.50; June 20, 1916; 1 year; Sec. C, 439-475.
- Robbins, Levi, Port Norris; ground No. 295; acreage, 29; \$14.50; June 20, 1916; 1 year; Sec. C, 60-317-479; Sec. D, 116.
- Robbins, Edward C., Port Norris; ground No. 296; acreage, 37; \$18.50; June 20, 1916; 1 year; Sec. C, 59-61-62; Sec. D, 113.
- Robbins, Levi and Edw. C., Port Norris; ground No. 297; acreage, 187; \$93.50; June 20, 1916; 1 year; Sec. A, 265; Sec. B, 128-102-113-126; Sec. C, 64-624-609; Sec. D, 504.
- Robbins, George, Port Norris; ground No. 299; acreage, 245; \$121.00; June 20, 1916; 1 year; Sec. A, 166-252-202; Sec. B, 71-129; Sec. C, 445-89-440-470; Sec. D, 406-506-561.
- Robbins, Samuel L., Port Norris; ground No. 287; acreage, 61; \$30.50; June 20, 1916; 1 year; Sec. A, 183; Sec. C, 9; Sec. D, 271-255.
- Roe, J. Wesley, Leesburg; ground No. 303; acreage, 17; \$8.50; June 20, 1916; 1 year; Sec. A, 144.
- Rogers Est. & Whilden, Merchantville; ground No. 310; acreage, 195; \$97.50; June 20, 1916; 1 year; Sec. A, 53; Sec. C, 383-384-586; Sec. D, 83.
- Rogers, Maurice A., Est., Merchantville; ground No. 809; acreage, 357; \$181.00; June 20, 1916; 1 year; Sec. A, 189; Sec. B, 8-106; Sec. C, 348-377-461-435-99-176-226-347; Sec. D, 298-62-12-13-141.
- Schoch, George Y., Ocean City; ground No. 360; acreage, 661; \$341.00; June 20, 1916; 1 year; Sec. A, 270-105-217; Sec. B, 194-149; Sec. C, 453-375-339-420-442; Sec. D, 37-39-535-520.
- Schoch & Sharp, Ocean City; ground No. 363; acreage, 84; \$44.00; June 20, 1916; 1 year; Sec. A, 214; Sec. B, 140; Sec. D, 38-93.
- Sharp, Levi B., Hellserville; ground No. 332; acreage, 32; \$16.00; June 20, 1916; 1 year; Sec. B, 30; Sec. D, 418.
- Sharp, Ira P., Vineland; ground No. 334; acreage, 91; \$45.50; June 20, 1916; 1 year; Sec. A, 215; Sec. C, 606.
- Sharp, John W., Leesburg; ground No. 333; acreage, 21; \$10.50; June 20, 1916; 1 year; Sec. D, 312.
- Sharp, Walter L., Port Norris; ground No. 330; acreage, 12; \$6.00; June 20, 1916; 1 year; Sec. A, 230.
- Sharp, Zadok C. and Zadok R., Leesburg; ground No. 329; acreage, 133; \$66.50; June 20, 1916; 1 year; Sec. A, 232-241; Sec. C, 614.
- Sharp, Zadok R., Jr., Leesburg; ground No. 327; acreage, 36; \$18.00; June 20, 1916; 1 year; Sec. A, 149; Sec. C, 544.
- Sharp, Zadok C., Sr., Leesburg; ground No. 328; acreage, 30; \$15.00; June 20, 1916; 1 year; Sec. A, 145; Sec. B, 61.
- Sharpless, John T., Millville; ground No. 335; acreage, 296; \$154.50; June 20, 1916; 1 year; Sec. A, 90-133-134; Sec. B, 205; Sec. C, 169-170-168-405-460; Sec. D, 107-240-579.
- Sharpless, John T., Millville; ground No. 130; acreage, 8; \$5.00; April 8, 1916, to June 20, 1916, 2 months, 12 days; Sec. C, 156.
- Shaw, Howard, Leesburg; ground No. 345; acreage, 19; \$9.50; June 20, 1916; 1 year; Sec. A, 263; Sec. D, 600.
- Sheppard, Ralph A., Blvalve; ground No. 331; acreage, 18; \$9.00; June 20, 1916; 1 year; Sec. C, 257.
- Sheppard, S. Ware, Newport; ground No. 339; acreage, 60; \$30.00; June 20, 1916; 1 year; Sec. A, 227; Sec. C, 276-278-415; Sec. D, 129.

- Sheppard & Smith, Newport; ground No. 340; acreage, 81; \$40.50; June 20, 1916; 1 year; Sec. C, 615; Sec. D, 546.
- Sheppard, Harrison, Mauricetown; ground No. 337; acreage, 86; \$43.00; June 20, 1916; 1 year; Sec. A, 168; Sec. C, 191-374.
- Sheppard, Lewis F., Cedarville; ground No. 338; acreage, 253; \$126.50; June 20, 1916; 1 year; Sec. B, 202; Sec. C, 44-311-116-119-336; Sec. D, 497-559-180-184-361-409.
- Sheppard & Powell, Cedarville; ground No. 344; acreage, 36; \$18.00; June 20, 1916; 1 year; Sec. C, 617.
- Shropshire, Ed., Haleyville; ground No. 347; acreage, 95; *\$47.00; June 20, 1916; 1 year; Sec. A, 216-249; Sec. B, 172-65; Sec. C, 386-419.
- Shull, John L., Newport; ground No. 346; acreage, 212; *\$108.50; June 20, 1916; 1 year; Sec. A, 234; Sec. B, 83-84; Sec. C, 607-85-237-329; Sec. D, 64-172-801.
- Smith, Asa C., Leesburg; ground No. 342; acreage, 109; *\$46.50; June 20, 1916; 1 year; Sec. A, 33-143; Sec. D, 593.
- Smith, Seth S., Leesburg; ground No. 343; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. A, 261.
- Smith, Henry C., Newport; ground No. 341; acreage, 90; \$45.00; June 20, 1916; 1 year; Sec. C, 272-298-452.
- Sockwell & Gaskill, Port Norris; ground No. 358; acreage, 30; \$15.00; June 20, 1916; 1 year; Sec. B, 11; Sec. C, 41.
- Sockwell & Polhamus, Port Norris; ground No. 359; acreage, 77; \$38.50; June 20, 1916; 1 year; Sec. A, 255-306; Sec. C, 103-190-583; Sec. D, 85-380.
- Sockwell, Howard W., Port Norris; ground No. 357; acreage, 574; *\$289.00; June 20, 1916; 1 year; Sec. A, 274-287; Sec. B, 70; Sec. C, 11-366-349-228-52-540-47-48-49-50-51; Sec. D, 460.
- Simpkins, Albert, Cedarville; ground No. 336; acreage, 39; \$19.50; June 20, 1916; 1 year; Sec. C, 311-116-119-336; Sec. D, 497-559-180-184.
- Stites, Edmund, Jr., Port Norris; ground No. 351; acreage, 383; \$191.50; June 20, 1916; 1 year; Sec. B, 164-173-237; Sec. C, 361-393-399-423-152-153-322; Sec. D, 288.
- Stites, Howard, Newport; ground No. 354; acreage, 18; \$9.00; June 20, 1916; 1 year; Sec. C, 398.
- Stites & Newcomb, Wm. B., Newport; ground No. 353; acreage, 122; \$61.00; June 20, 1916; 1 year; Sec. B, 131; Sec. C, 255-591; Sec. D, 411.
- Stites, Gilbert and John, Dragston; ground No. 350; acreage, 33; *\$19.50; June 20, 1916; 1 year; Sec. A, 226; Sec. D, 300-279.
- Stites, Mary B., Port Norris; ground No. 364; acreage, 67; \$33.50; June 20, 1916; 1 year; Sec. C, 229-387.
- Sutter, Harry, Port Norris; ground No. 365; acreage, 31; *\$19.00; June 20, 1916; 1 year; Sec. A, 169; Sec. D, 607.
- Sutter, Jacob, Port Norris; ground No. 366; acreage, 12; \$6.00; June 20, 1916; 1 year; Sec. D, 103.
- Sutton, Joseph, Leesburg; ground No. 349; acreage, 13; \$6.50; June 20, 1916; 1 year; Sec. A, 119.
- Sutton, William G., Bridgeton; ground No. 348; acreage, 17; \$8.50; June 20, 1916; 1 year; Sec. C, 600.
- Sutton & Henderson, Leesburg; ground No. 368; acreage, 28; *\$18.00; June 20, 1916; 1 year; Sec. D, 609.
- Swank, David, Port Norris; ground No. 326; acreage, 9; \$5.00; June 20, 1916; 1 year; Sec. C, 525.
- Terry, George N., Dividing Creek; ground No. 376; acreage, 96; \$48.00; June 20, 1916; 1 year; Sec. B, 105-232; Sec. D, 117.
- Terry & Terry, Dividing Creek; ground No. 377; acreage, 25; \$12.50; June 20, 1916; 1 year; Sec. C, 404.
- Tilghman, Eva, Port Norris; ground No. 386; acreage, 26; \$13.00; June 20, 1916; 1 year; Sec. D, 109.
- Tozour, Chas., Delmont; ground No. 383; acreage, 76; *\$39.50; June 20, 1916; 1 year; Sec. B, 150-133-157; Sec. C, 545; Sec. D, 548.
- Turner, Leaming, Dividing Creek; ground No. 381; acreage, 32; \$16.00; June 20, 1916; 1 year; Sec. D, 123-182-350.

- Turner, Jas. A., Newport; ground No. 379; acreage, 89; \$44.50; June 20, 1916; 1 year; Sec. B, 233; Sec. C, 613; Sec. D, 100-432-452.
- Turner, May, Newport; ground No. 380; acreage, 23; \$11.50; June 20, 1916; 1 year; Sec. D, 76-167.
- Turpin & Collins, Bridgeton; ground No. 385; acreage, 20; \$10.00; June 20, 1916; 1 year; Sec. A, 194; Sec. D, 364-392.
- Townsend, Stacy, Leesburg; ground No. 382; acreage, 56; *\$35.50; June 20, 1916; 1 year; Sec. D, 356-002.
- Van Vliet, William, Newport; ground No. 395; acreage, 21; \$10.50; June 20, 1916; 1 year; Sec. D, 383.
- Veale, William, Dividing Creek; ground No. 393; acreage, 15; \$7.50; June 20, 1916; 1 year; Sec. B, 243.
- Veale & Loper, Dividing Creek; ground No. 394; acreage, 234; \$117.00; June 20, 1916; 1 year; Sec. B, 125-170-203; Sec. C, 353-457-490; Sec. D, 132-21-126-127.
- Wallen, David, Fairton; ground No. 406; acreage, 22; \$11.00; June 20, 1916; 1 year; Sec. C, 437.
- Wallen Est., Wallen & Whitaker, Fairton; ground No. 400; acreage, 297; \$148.50; June 20, 1916; 1 year; Sec. B, 33-34; Sec. C, 230-235-308-175-244-309-178; Sec. D, 186-188.
- Welch & Lilliston, Hopewell or Dorchester; ground No. 406; acreage, 38; \$19.00; June 20, 1916; 1 year; Sec. A, 268; Sec. B, 180.
- Westcott & Trenchard, Fairton; ground No. 401; acreage, 203; *\$98.00; June 20, 1916; 1 year; Sec. B, 36; Sec. C, 140-640; Sec. D, 543-57-58-525.
- Willis, Frank L., Cedarville; ground No. 399; acreage, 39; \$19.50; June 20, 1916; 1 year; Sec. D, 471-551.
- Whilden, Somers H., Mauricetown; ground No. 402; acreage, 66; \$33.00; June 20, 1916; 1 year; Sec. A, 91; Sec. C, 385-74-75.
- Windfohr, Arthur, Bivalve; ground No. 408; acreage, 79; \$39.50; June 20, 1916; 1 year; Sec. B, 148-181; Sec. C, 172; Sec. D, 169-477.
- Yates, G. Christy, Port Norris; ground No. 409; acreage, 334; *\$166.00; June 20, 1916; 1 year; Sec. B, 227-278; Sec. C, 194-391-424-350-392-77-57; Sec. D, 111-164-198-121-398-224-250-268.
- Yates & Gaskill, Port Norris; ground No. 410; acreage, 30; \$15.00; June 20, 1916; 1 year; Sec. D, 589.
- Yates, Hoffman & Robbins, Port Norris; ground No. 412; acreage, 212; \$106.00; June 20, 1916; 1 year; Sec. A, 159-271; Sec. B, 123-229; Sec. C, 497-65-467-494.

OYSTER BED LEASES—DEPARTMENT OF THE ATLANTIC COAST. Division of Burlington, Ocean and Monmouth Counties.

- Allen, C. H., New Gretna; ground Nos. 21-39-68-104; acreage, 14½; \$14.25; June 20, 1916; 1 year; Secs. A and B.
- Allen, Edward K., New Gretna; ground Nos. 42-78; acreage, 8; \$8.00; June 20, 1916; 1 year; Sec. A.
- Allen, E. K., & Co., New Gretna; ground No. 165; acreage, 25½; \$25.50; June 20, 1916; 1 year; Sec. B.
- Allen, Thomas A., New Gretna; ground Nos. 43-27; acreage, 4¾; \$4.75; June 20, 1916; 1 year; Sec. A.
- Allen, Harry M., New Gretna; ground No. 75; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. A.
- Allen, John L., New Gretna; ground Nos. 19-54; acreage, 3¾; \$3.75; June 20, 1916; 1 year; Sec. A.
- Allen, Thomas A., New Gretna; ground Nos. 81-90; acreage, 2¼; \$2.50; June 20, 1916; 1 year; Sec. A.
- Allen, Caleb F., New Gretna; ground Nos. 25-73; acreage, 2¼; \$2.50; June 20, 1916; 1 year; Sec. A.
- Allen, Chester, New Gretna; ground Nos. 77-100-174; acreage, 12¼; \$12.25; June 20, 1916; 1 year; Secs. A and B.
- Allen, Washington C., New Gretna; ground Nos. 57-88-103; acreage, 5¾; \$5.75; June 20, 1916; 1 year; Secs. A and B.

BOARD OF SHELL FISHERIES.

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- Adams, John F., New Gretna; ground Nos. 101-123; acreage, $9\frac{1}{2}$; \$9.50; June 20, 1916; 1 year; Sec. B.
- Adams, Ernest G., New Gretna; ground Nos. 67-83-44; acreage, $9\frac{1}{4}$; \$9.25; June 20, 1916; 1 year; Sec. A.
- Adams, Elmer, Port Republic; ground Nos. 146-149; acreage, $8\frac{1}{4}$; \$8.50; June 20, 1916; 1 year; Sec. B.
- Allen, Joseph B., Tuckerton; ground No. 53; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. A.
- Allen, Joseph B., Sr., Tuckerton; ground Nos. 40-37; acreage, $20\frac{1}{2}$; \$20.50; June 20, 1916; 1 year; Sec. A.
- Allen, Walter S., Tuckerton; ground Nos. 29-20-2-105-170-172; acreage, $83\frac{1}{2}$; \$33.50; June 20, 1916; 1 year; Secs. A and B.
- Allen, Samuel B., Tuckerton; ground No. 48; acreage, 6; \$6.00; June 20, 1916; 1 year; Sec. A.
- Anderson, L. and G. Price, Tuckerton; ground No. 294; acreage, $2\frac{1}{4}$; \$2.25; June 20, 1916; 1 year; Sec. C.
- Anderson, Samuel, Tuckerton; ground No. 247; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. C.
- Abbott, William, Manahawkin; ground Nos. 707-745-751; acreage, 9; \$9.00; June 20, 1916; 1 year; Sec. F.
- Bogan, Annie, New Gretna; ground No. 102; acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. B.
- Bogan, Richard S., New Gretna; ground No. 99; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. B.
- Bartlett, John W., Tuckerton; ground No. 204; acreage, $6\frac{1}{4}$; \$6.25; June 20, 1916; 1 year; Sec. C.
- Bennett, Josiah, Tuckerton; ground No. 224; acreage, $1\frac{1}{4}$; \$1.75; June 20, 1916; 1 year; Sec. C.
- Baker, Harry, Tuckerton; ground No. 281; acreage, $6\frac{1}{4}$; \$6.25; June 20, 1916; 1 year; Sec. C.
- Bowen, Calvin, Tuckerton; ground No. 218; acreage, $2\frac{1}{4}$; \$2.50; June 20, 1916; 1 year; Sec. C.
- Brown, James D., Tuckerton; ground No. 316; acreage, $5\frac{1}{4}$; \$5.25; June 20, 1916; 1 year; Sec. C.
- Brown, John W., Parkertown; ground Nos. 461-458-534; acreage, 10%; \$10.75; June 20, 1916; 1 year; Sec. C.
- Brown, Ezra P., West Creek; ground Nos. 404-407-610-641-658-674-884-546; acreage, $82\frac{1}{2}$; \$32.50; June 20, 1916; 1 year; Secs. D and E.
- Brown, Ezra P., West Creek; Sec. F.
- Birdsall, Jesse, Barnegat; ground No. 20; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. F.
- Birdsall, John, Barnegat; ground No. X, acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. F.
- Brand, George W., Port Republic; ground No. 154; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. B.
- Bates, Henry, Est., Port Republic; ground No. 151; acreage, $32\frac{1}{4}$; \$32.25; June 20, 1916; 1 year; Sec. B.
- Cranmer, Rufus, Manahawkin; ground Nos. 757-718-808; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. E.
- Cranmer, Thomas, Manahawkin; ground Nos. 465-725-740-734-738-704-700-723-X-X-752-719; acreage, $100\frac{1}{4}$; \$109.50; June 20, 1916; 1 year; Sec. F.
- Cranmer, James H., Manahawkin; ground No. 8; acreage, 6; \$6.00; June 20, 1916; 1 year; Sec. F.
- Cranmer, Joseph T., Manahawkin; ground Nos. 709-727-733; acreage, $6\frac{1}{4}$; \$6.50; June 20, 1916; 1 year; Sec. G.
- Cranmer, James R., Barnegat; ground No. 30; acreage, 3; \$3.00; June 20, 1916; 1 year
- Cranmer, M. L., Mayetta; ground Nos. 763-764-766-767-803-804-812-815; acreage, $50\frac{1}{4}$; \$50.25; June 20, 1916; 1 year; Sec. E.
- Cranmer, Harvey G., Mayetta; ground Nos. 762-814; acreage, $18\frac{1}{4}$; \$18.25; June 20, 1916; 1 year; Sec. E.
- Cranmer Ashbrook, Mayetta; ground Nos. 776-794; acreage $12\frac{1}{4}$; \$12.50; June 20, 1916; 1 year.

- Cranmer, Lewis A., Mayetta; ground No. 778; acreage, 2¼; \$2.75; June 20, 1916; 1 year; Sec. E.
- Conklin, Calvin, Cedar Run; ground Nos. 773-787-780; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. E.
- Conklin, Robert, Cedar Run; ground Nos. 796-802-808; acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. E.
- Conklin, Lewis A., Cedar Run; ground No. 785; acreage, 7; \$7.00; June 20, 1916; 1 year; Sec. E.
- Conklin, Isaac, Cedar Run; ground No. 791; acreage, 6¾; \$6.75; June 20, 1916; 1 year; Sec. E.
- Conklin, Samuel B., Cedar Run; ground No. 786; acreage, 12; \$12.00; June 20, 1916; 1 year; Sec. E.
- Cranmer, Levi, Cedar Run; ground No. 774; acreage, 3½; \$3.50; June 20, 1916; 1 year; Sec. E.
- Cranmer, Job, Cedar Run; ground No. 798; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. E.
- Cranmer, Irving, Cedar Run; ground Nos. 765-806; acreage, 7; \$7.00; June 20, 1916; 1 year; Sec. E.
- Cranmer, George A., Cedar Run; ground Nos. 792-775; acreage, 4½; \$4.50; June 20, 1916; 1 year; Sec. E.
- Cranmer, Augustus, Cedar Run; ground Nos. 190-781; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Sec. E.
- Cranmer, Howard, Cedar Run; ground No. 795; acreage, 3; \$3.00; June 20, 1916; 1 year.
- Cranmer, Thomas L., Cedar Run; ground No. 784; acreage, 8; \$8.00; June 20, 1916; 1 year.
- Cranmer, Samuel, Cedar Run; ground No. 782; acreage, 6; \$6.00; June 20, 1916; 1 year; Sec. E.
- Cranmer, William A., Bridgeton; ground No. 783; acreage, 2½; \$2.50; June 20, 1916; 1 year; Sec. E.
- Cranmer, Chester, Mayetta; ground No. 813; acreage, 4¼; \$4.75; June 20, 1916; 1 year. Sec. E.
- Cranmer, William A., Brigantine; ground No. 783; acreage, 2¼; \$2.75; June 20, 1916; 1 year; Sec. E.
- Cummings, Chas., Parkertown; ground Nos. 472-523; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Sec. D.
- Cummings, Silas, Parkertown; ground Nos. 474-527; acreage, 6½; \$6.50; June 20, 1916; 1 year; Sec. D.
- Cummings, Eugene, Parkertown; ground No. 518; acreage, 2½; \$2.50; June 20, 1916; 1 year; Sec. D.
- Cowperthwait, W. H., West Creek; ground Nos. 433-487-719-736-737; acreage, 27½; \$27.50; June 20, 1916; 1 year; Secs. D and E.
- Cobb, Thomas, West Creek; ground No. 638; acreage, 2; \$2.00; June 20, 1916; 1 year; Sec. E.
- Cranmer, Ellis and Phineas, West Creek; ground Nos. 816-506-621; acreage, 18; \$18.00; June 20, 1916; 1 year; Sec. E.
- Cranmer, Jos. W., West Creek; ground Nos. 402-406-606-696; acreage, 20½; \$20.50; June 20, 1916; 1 year; Secs. D and E.
- Cranmer, A. S., West Creek; ground Nos. 712-749; acreage, 3¾; \$3.75; June 20, 1916; 1 year; Sec. E.
- Cranmer, Oliver, West Creek; ground Nos. 760-769-770-806; acreage, 10¼; \$10.25; June 20, 1916; 1 year; Sec. E.
- Cox, J. B., West Creek; ground No. 499; acreage, 2; \$2.00; June 20, 1916; 1 year; Sec. D.
- Cox, George M., West Creek; ground Nos. 443-654-714; acreage, 5¾; \$5.75; June 20, 1916; 1 year; Sec. D.
- Cox, C. H. and N. B., West Creek; ground No. 725; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. E.
- Cox, Nathan B., West Creek; ground Nos. 663-685; acreage, 2¼; \$2.25; June 20, 1916; 1 year; Sec. E.
- Cox, Jonathan, West Creek; ground No. 546; acreage, 8¼; \$8.25; June 20, 1916; 1 year; Sec. E.
- Cox Bros., Tuckerton; ground Nos. 258-225-250-309-339; acreage, 19¼; \$19.25; June 20, 1916; 1 year; Sec. C.

BOARD OF SHELL FISHERIES.

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Cowperthwait, T. J., Tuckerton; ground No. 208; acreage, 2½; \$2.50; June 20, 1916; 1 year; Sec. C.

Crane, Howard, Tuckerton; ground No. 215; acreage, 2¼; \$2.75; June 20, 1916; 1 year; Sec. C.

Conover, Elias, Port Republic; ground No. 125; acreage, 4¼; \$4.25; June 20, 1916; 1 year; Sec. B.

Cavileer, John D., Port Republic; ground No. 128; acreage, 7½; \$7.50; June 20, 1916; 1 year; Sec. B.

Cavileer, Gilbert, Port Republic; ground No. 162; acreage, 2¼; \$2.75; June 20, 1916; 1 year; Sec. B.

Cavileer, D. F., Port Republic; ground No. 159; acreage, 1½; \$1.50; June 20, 1916; 1 year; Sec. B.

Cranmer, Arnold, New Gretna; ground Nos. 36-35-8-17-62-85-263-312-306-344; acreage, 89; \$89.00; June 20, 1916; 1 year; Secs. A and D.

Cranmer, Harry G., New Gretna; ground Nos. 45-175; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Secs. A and B.

Cranmer, Daniel D., New Gretna; ground No. 70; acreage, 8¼; \$8.75; June 20, 1916; 1 year; Sec. A.

Cranmer, Milton A., New Gretna; ground No. 80; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. A.

Darby, J. W., Tuckerton; ground Nos. 46-89-X-93-83-178; acreage, 13¼; \$13.50; June 20, 1916; 1 year; Secs. A and B.

Driscall, Edward, Tuckerton; ground No. X; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. B.

Driscall, Enoch, Tuckerton; ground No. 208; acreage, 1¼; \$1.75; June 20, 1916; 1 year; Sec. C.

Driscall, Harry, Tuckerton; ground No. 237; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. C.

Driscall, Reuben, Tuckerton; ground No. 239; acreage, 3¼; \$3.25; June 20, 1916; 1 year; Sec. C.

Driscall, Houston, Tuckerton; ground No. 241; acreage, 5¼; \$5.75; June 20, 1916; 1 year; Sec. C.

Dunfee, Thomas, Cedar Run; ground No. 800; acreage, 2; \$2.00; June 20, 1916; 1 year; Sec. E.

Elbertson, Mertee, Manahawkin; ground No. X; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. F.

Estelow, Sadoc, Barnegat; ground No. 6; acreage, 2; \$2.00; June 20, 1916; 1 year; Sec. F.

Endicott, Mark, Port Republic; ground No. 181; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. B.

Feshall, John, Manahawkin; ground No. 728; acreage, 8½; \$8.50; June 20, 1916; 1 year; Sec. F.

Fennimore, Alfred, West Creek; ground Nos. 607-636-676-707-708-709-711; acreage, 36¼; \$36.25; June 20, 1916; 1 year.

Frazier, Frank, Tuckerton; ground No. 156; acreage, 2¼; \$2.50; June 20, 1916; 1 year; Sec. B.

Fisk, Lewis, Tuckerton; ground No. 206; acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. C.

Fisk, H. L. and Lewis, Tuckerton; ground No. 268; acreage, 9; \$9.00; June 20, 1916; 1 year; Sec. C.

Falkinburg, Edward, Tuckerton; ground No. 260; acreage, 11; \$11.00; June 20, 1916; 1 year; Sec. C.

Gaskill, Jesse, New Gretna; ground No. 9; acreage, 1¼; \$1.25; June 20, 1916; 1 year; Sec. A.

Gaskill, Thos. J., & Son, New Gretna; ground Nos. 22-51-69-97-26-59-74-81-91; acreage, 6¼; \$6.75; June 20, 1916; 1 year; Sec. A.

Gale, George E., Tuckerton; ground Nos. 207-211-230-298; acreage, 16¼; \$16.50; June 20, 1916; 1 year; Sec. D.

Gale, Harvey E., Tuckerton; ground No. 323-317; acreage, 15¼; \$15.75; June 20, 1916; 1 year; Sec. C.

Gale, Wm. H., Tuckerton; ground No. 102; acreage, 1¼; \$1.50; June 20, 1916; 1 year; Sec. B.

- Garrison, Eugene, Tuckerton; ground Nos. 201-269-262; acreage, 10¼; \$10.25; June 20, 1916; 1 year; Sec. C.
- Gifford, Larner, Tuckerton; ground No. 260; acreage, 2¾; \$2.75; June 20, 1916; 1 year; Sec. C.
- Gaskill, Wm. F., Tuckerton; ground No. 282; acreage, 7½; \$7.50; June 20, 1916; 1 year; Sec. C.
- Gaskill, John W., Tuckerton; ground No. 269; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Sec. C.
- Grant, Jesse, Lanoka; ground No. 20; acreage, 6; \$6.00; June 20, 1916; 1 year.
- Grant, William H., Lanoka; ground No. X-2-1003; acreage, 15; \$15.00; June 20, 1916; 1 year.
- Grant, John, Lanoka; ground No. 1001; acreage, 4; \$4.00; June 20, 1916; 1 year.
- Haywood, J. P., West Creek; ground Nos. 621-500-614-649-652-677-697-704-705-706-732; acreage, 31¼; \$31.25; June 20, 1916; 1 year; Secs. D and E.
- Holman, Bertha, West Creek; ground No. 775; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. E.
- Holman, Joseph, West Creek; ground No. 424; acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. E.
- Holman & Parker, West Creek; ground No. 600; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. E.
- Horner, Charles, Parkertown; ground Nos. 611-662-509; acreage, 9¾; \$9.75; June 20, 1916; 1 year; Sec. E.
- Haywood, Frank, Manahawkin; ground Nos. 1-2-708; acreage, 11¾; \$11.75; June 20, 1916; 1 year; Sec. F.
- Hazelton, Leon, Manahawkin; ground No. X, acreage, 2; \$2.00; June 20, 1916; 1 year; Sec. F.
- Hollingsworth, George, Barnegat; ground Nos. 46-94-10-19-41-36-22-27-11-7-2; acreage, 79; \$79.00; June 20, 1916; 1 year.
- Holmes, Edward L., Forked River; ground No. X, acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. F.
- Inman, Clinton, Barnegat; ground Nos. 28-28½-11-38; acreage, 5½; \$5.50; June 20, 1916; 1 year; Sec. F.
- Heints, Harry, New Gretna; ground No. 158; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. B.
- Huntley, Charles, Port Republic; ground Nos. 142-145-152; acreage, 11; \$11.00; June 20, 1916; 1 year; Sec. B.
- Hewitt, Nelson, Port Republic; ground No. 148; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. B.
- Hewitt, Jesse L., Port Republic; ground No. 144; acreage, 1¼; \$1.25; June 20, 1916; 1 year; Sec. B.
- Huntley, Fred, Port Republic; ground No. 132; acreage, 11¾; \$11.25; June 20, 1916; 1 year; Sec. B.
- Hickman, Wilbur, Port Republic; ground Nos. 147-150; acreage, 2¾; \$2.75; June 20, 1916; 1 year; Sec. B.
- Higbee, Samuel, Port Republic; ground No. 163; acreage, 11½; \$11.50; June 20, 1916; 1 year; Sec. B.
- Hickman, Oscar, Tuckerton; ground Nos. 155-276; acreage, 14; \$14.00; June 20, 1916; 1 year; Secs. B and C.
- Horner, George A., and Harvey Stiles, Tuckerton; ground No. 283; acreage, 5¼; \$5.50; June 20, 1916; 1 year; Sec. C.
- Horner, Samuel, Tuckerton; ground No. 213; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Sec. C.
- Heinrich, Edward, Tuckerton; ground No. 291; acreage, 9¾; \$9.75; June 20, 1916; 1 year; Sec. C.
- Holman, M. W., & Atmore, Parkertown; ground Nos. 437-463; acreage, 12¾; \$12.75; June 20, 1916; 1 year; Sec. C.
- Horner, Isaac, Parkertown; ground Nos. 426-435-436; acreage, 26¾; \$26.50; June 20, 1916; 1 year; Sec. D.
- Horner, James O., Parkertown; ground No. 431; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. D.
- Jones, Samuel A., Tuckerton; ground Nos. 277-279-244; acreage, 22; \$22.00; June 20, 1916; 1 year; Sec. C.

- Jones, Wilbur, Tuckerton; ground No. 282; acreage, $3\frac{1}{4}$; \$3.75; June 20, 1916; 1 year; Sec. C.
- Jones, Joseph H., Tuckerton; ground No. 280; acreage, $9\frac{1}{4}$; \$9.25; June 20, 1916; 1 year; Sec. C.
- Jones, Wm. J., West Creek; ground Nos. 624-726; acreage, $2\frac{1}{4}$; \$2.25; June 20, 1916; 1 year; Secs. C and E.
- Jones, A. H., West Creek; ground Nos. 430-412; acreage, $11\frac{1}{2}$; \$11.50; June 20, 1916; 1 year; Sec. D.
- Jones, John F., West Creek; ground Nos. 482-661-702; acreage, $5\frac{1}{2}$; \$5.75; June 20, 1916; 1 year; Sec. D.
- Johnson, I. C., West Creek; ground No. 671; acreage, $5\frac{1}{2}$; \$5.75; June 20, 1916; 1 year; Sec. E.
- Jeffrey, Howard, Lanoka; ground No. 5; acreage, 10; \$10.00; June 20, 1916; 1 year.
- Kelly, Wynn, Tuckerton; ground No. 212; acreage, $5\frac{1}{2}$; \$5.50; June 20, 1916; 1 year; Sec. C.
- Kelly, T. C., & Son, West Creek; ground Nos. 429-451-448-457-484-488-491-608-604-644-645-681-701-713; acreage, 107; \$107.00; June 20, 1916; 1 year; Secs. D and E.
- Kelly, Amanda, West Creek; ground No 605; acreage, $12\frac{1}{4}$; \$12.75; June 20, 1916; 1 year; Sec. B.
- Kelly, N. E., West Creek; ground Nos. 420-483-650-653-680-695-699; acreage, $34\frac{1}{4}$; \$34.25; June 20, 1916; 1 year; Secs. D and E.
- Kelly, Eugene, West Creek; ground Nos. 494-456-613-700; acreage, 20; \$20.00; June 20, 1916; 1 year; Secs. D and E.
- Kelly, James E., West Creek; ground Nos. 432-691-693; acreage, $7\frac{1}{2}$; \$7.50; June 20, 1916; 1 year; Secs. D and E.
- Kelly, H. F., West Creek; ground Nos. 413-612-656-682-693-728; acreage, $11\frac{1}{2}$; \$11.75; June 20, 1916; 1 year; Secs. D and E.
- Kelly, P. W., West Creek; ground No. 575; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. E.
- Kelly, Mannas D., West Creek; ground Nos. 408-471-741; acreage, $9\frac{1}{4}$; \$9.50; June 20, 1916; 1 year; Sec. D.
- Kelly, C. D., & Geo. Y. Schoch, West Creek; ground Nos. 422-630-672-508; acreage, $64\frac{1}{4}$; \$64.50; June 20, 1916; 1 year; Secs. D and E.
- Kelly, J. H., West Creek; ground Nos. 635-651-678; acreage, $9\frac{1}{4}$; \$9.75; June 20, 1916; 1 year; Sec. E.
- King, John, Barnegat; ground No. 4; acreage, $3\frac{1}{4}$; \$3.25; June 20, 1916; 1 year.
- Loveland, Jesse, New Gretna; ground No. 140; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. B.
- Loveland, Benj. F., New Gretna; ground Nos. 139-141-X-X; acreage, 11; \$11.00; June 20, 1916; 1 year; Sec. B.
- Loveland, Jesse A., New Gretna; ground No. 140; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. B.
- Leigh, Sarah, West Creek; ground Nos. 610-684; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. E.
- Lampson, Joel, Mayetta; ground No. 801; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. E.
- Leeds, Risley, Leeds Point; ground No. 143; acreage, $3\frac{1}{4}$; \$3.25; June 20, 1916; 1 year; Sec. B.
- Lister, Robert P., Newark; ground No. X; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. F.
- Lumberger, Fred, Barnegat; ground No. 5; acreage, $7\frac{1}{4}$; \$7.25; June 20, 1916; 1 year; Sec. F.
- Lamson, Joseph A., Cedar Run; ground No. 801; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. E.
- Mott, George A., Tuckerton; ground No. 151; acreage, $7\frac{1}{4}$; \$7.25; June 20, 1916; 1 year; Sec. B.
- Mott, George W., Tuckerton; ground No. 209; acreage, $1\frac{1}{4}$; \$1.75; June 20, 1916; 1 year; Sec. C.
- Mott, Milton J., Tuckerton; ground No. 267; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. C.
- Mott, Eldridge, Tuckerton; ground No. 123-108; acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. C.

- Mott, Joel R., Tuckerton; ground No. 109; acreage, 1¼; \$1.25; June 20, 1916; 1 year; Sec. C.
- Marshall, Solomon, Tuckerton; ground No. 216; acreage, 6¼; \$6.75; June 20, 1916; 1 year; Sec. C.
- Marshall, Geo. and James, Tuckerton; ground No. 227; acreage, 8¼; \$8.25; June 20, 1916; 1 year.
- Marshall, Noah, Tuckerton; ground No. 228; acreage, 2¼; \$2.75; June 20, 1916; 1 year; Sec. C.
- Moshier, I. O., Tuckerton; ground No. 242; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. C.
- Morris, Wm. A., Tuckerton; ground No. 285; acreage, 4¼; \$4.75; June 20, 1916; 1 year; Sec. C.
- Mathis, Ira C., Tuckerton; ground No. 285; acreage, 3¼; \$3.25; June 20, 1916; 1 year; Sec. C.
- Mathis, Daniel S., Tuckerton; ground No. 261; acreage, 7¼; \$7.25; June 20, 1916; 1 year; Sec. C.
- Mathis, Wm. A., Tuckerton; ground Nos. 286-380; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. C.
- Mathis, Lewis L., Tuckerton; ground No. 270; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. C.
- McDaniels, R. W., Tuckerton; ground No. 295; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Sec. C.
- Mathis, Lois, New Gretna; ground Nos. 704-50; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Secs. A and B.
- Mathis, Walter R., New Gretna; ground No. 84; acreage, 3¼; \$3.75; June 20, 1916; 1 year; Sec. A.
- Mathis, Wm. A., New Gretna; ground No. 18; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. A.
- Mathis, Caleb A., New Gretna; ground No. 137; acreage, 5¼; \$5.50; June 20, 1916; 1 year; Sec. B.
- Mathis, Harry C., New Gretna; ground No. 82; acreage, 7¼; \$7.25; June 20, 1916; 1 year; Sec. A.
- Mathis, Joshua, New Gretna; ground No. 52; acreage, 1¼; \$1.25; June 20, 1916; 1 year; Sec. A.
- McAnney, John, New Gretna; ground Nos. 58-72; acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. A.
- Mathis, J. Frank, Leeds Point; ground Nos. 88-93-95; acreage, 27¼; \$27.50; June 20, 1916; 1 year; Sec. A.
- Martin, Humphry, Manahawkin; ground No. 711; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. F.
- Martin, Frank, Manahawkin; ground Nos. 947-X; acreage, 10¼; \$10.50; June 20, 1916; 1 year; Sec. F.
- Martin, Benj., Manahawkin; ground No. 736; acreage, 4¼; \$4.25; June 20, 1916; 1 year; Sec. F.
- McCarty, Timothy, Lanoka; ground No. 18; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. F.
- Parker, J. W., & Bros., Tuckerton; ground Nos. 217-307-278-288-290-325-348-171-168-169; acreage, 151¼; \$151.50; June 20, 1916; 1 year; Secs. O and D.
- Parker, Barton S., Tuckerton; ground Nos. 246-342-326-332; acreage, 25¼; \$25.50; June 20, 1916; Sec. D.
- Parker, Alex, Tuckerton; ground No. 271; acreage, 12; \$12.00; June 20, 1916; 1 year; Sec. O.
- Pullen, B., Tuckerton; ground Nos. 210-266-329; acreage, 24¼; \$24.75; June 20, 1916; 1 year; Sec. C.
- Pullen, Frank, Tuckerton; ground Nos. 220-328; acreage, 2¼; \$2.75; June 20, 1916; 1 year; Sec. C.
- Parker, Henry D., Tuckerton; ground No. 440; acreage, 8¼; \$8.50; June 20, 1916; 1 year; Sec. O.
- Parker, Rudolph, Parkertown; ground Nos. 442-462; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. D.

- Parker, Henry, Parkertown; ground No. 450; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. D.
- Parker, Hansel & Henry, Parkertown; ground Nos. 473-506; acreage, 6; \$6.00; June 20, 1916; 1 year; Sec. D.
- Parker, Hirlo, Parkertown; ground No. 479; acreage, 2½; \$2.75; June 20, 1916; 1 year; Sec. D.
- Parker, M. F., Parkertown; ground No. 526; acreage, 17; \$17.00; June 20, 1916; 1 year; Sec. D.
- Parker, Ayer, Parkertown; ground No. 538; acreage, 3½; \$3.50; June 20, 1916; 1 year; Sec. D.
- Parker, J. W., Parkertown; ground No. 545; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. D.
- Parker, S. D., Parkertown; ground No. 481; acreage, 1½; \$1.75; June 20, 1916; 1 year; Sec. D.
- Parker, Linn, & Atmore Holman, Parkertown; ground No. 415; acreage, 16; \$16.00; June 20, 1916; 1 year; Sec. D.
- Parker, Thos., Sr., Parkertown; ground No. 480; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. D.
- Parker, Jay and Hasle, Parkertown; ground No. 423; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Sec. D.
- Parker, W. W., Parkertown; ground No. 475; acreage, 2½; \$2.75; June 20, 1916; 1 year; Sec. D.
- Parker, Hiram, Parkertown; ground No. 454; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. D.
- Price, Merritt, Parkertown; ground No. 417; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. D.
- Price, Abram, Parkertown; ground No. 418; acreage, 4¼; \$4.25; June 20, 1916; 1 year; Sec. D.
- Pharo, A. W., West Creek; ground Nos. 459-731; acreage, 4½; \$4.75; June 20, 1916; 1 year; Sec. D.
- Pharo, Frank, West Creek; ground Nos. 464-660-730; acreage, 5¼; \$5.25; June 20, 1916; 1 year; Sec. D.
- Potter, Wm. H., West Creek; ground Nos. 615-639; acreage, 14¼; \$14.25; June 20, 1916; 1 year; Sec. D.
- Parker, Ezra, Barnegat; ground Nos. 24-25; acreage, 5; \$5.00; June 20, 1916; 1 year; Sec. F.
- Perrine, Howard, Barnegat; ground Nos. 29-31-32; acreage, 7; \$7.00; June 20, 1916; 1 year; Sec. F.
- Potter, Reuben, Lanoka; ground No. 1002; acreage, 6; \$6.00; June 20, 1916; 1 year; Sec. F.
- Peterson, Geo. W., Barnegat; ground No. 40; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. F.
- Quinn, George, Tuckerton; ground Nos. 240-248-200-341; acreage, 13¼; \$13.25; June 20, 1916; 1 year; Sec. D.
- Robbins, Charles, New Gretna; ground Nos. 5-7-10-31-94; acreage, 9½; \$9.75; June 20, 1916; 1 year; Sec. A.
- Robbins, L. D., New Gretna; ground Nos. 30-32; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. A.
- Rosenholm, John, Tuckerton; ground Nos. 124-125-X; acreage, 18¼; \$18.75; June 20, 1916; 1 year; Sec. B.
- Rider, Anson J., & Son, Tuckerton; ground Nos. 253-249-272-264-340-331; acreage, 42¼; \$42.25; June 20, 1916; 1 year; Sec. C.
- Riley, Benj. F., Tuckerton; ground No. 222; acreage, 2; \$2.00; June 20, 1916; 1 year; Sec. C.
- Ripley, John, West Creek; ground No. 455; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. D.
- Rulon, Harper G., West Creek; ground Nos. 401-431-608-637-743; acreage, 27; \$27.00; June 20, 1916; 1 year; Secs. D and E.
- Rutter, R. F., West Creek; ground Nos. 485-609-646-679-718-724-733-637-657; acreage, 38½; \$38.75; June 20, 1916; 1 year; Secs. D and E.

- Rutter & Holman, West Creek; ground Nos. 438-403-445-498-720-751; acreage, 29; \$29.00; June 20, 1916; 1 year; Secs. D and E.
- Rutter, J. W., & J. S. Kelly, West Creek; ground No. 634; acreage, $3\frac{1}{4}$; \$3.25; June 20, 1916; 1 year; Sec. E.
- Rutter, T H., Barnegat; ground No. 44; acreage, $1\frac{1}{4}$; \$1.75; June 20, 1916; 1 year; Sec. F.
- Ridgway, Joseph H., Barnegat; ground Nos. 19-11-X; acreage, $12\frac{1}{4}$; \$12.50; June 20, 1916; 1 year; Sec. F.
- Ridgeway, Edward B., Barnegat; ground Nos. 20-45; acreage, $4\frac{1}{4}$; \$4.75; June 20, 1916; 1 year; Sec. F.
- Ridgway, Arthur J., Barnegat; ground No. 43; acreage, $2\frac{1}{4}$; \$2.75; June 20, 1916; 1 year; Sec. D.
- Ridgway, William, Barnegat; ground No. 8; acreage, 2; \$2.00; June 20, 1916; 1 year; Sec. F.
- Spragg, Phillip R., Tuckerton; ground Nos. 254-226-234-337; acreage, $11\frac{1}{4}$; \$11.75; June 20, 1916; 1 year; Sec. C.
- Spragg, Lewis, Tuckerton; ground Nos. 234-238-336; acreage, $9\frac{1}{4}$; \$9.50; June 20, 1916; 1 year; Sec. C.
- Spragg, Albert and Lewis, Tuckerton; ground Nos. 15-75-251; acreage, 7; \$7.00; June 20, 1916; 1 year; Sec. C.
- Spragg, Edward W., Tuckerton; ground No. 235; acreage, $1\frac{1}{4}$; \$1.75; June 20, 1916; 1 year; Sec. C.
- Sawyer, Joseph, Tuckerton; ground No. 300; acreage, $25\frac{1}{4}$; \$25.25; June 20, 1916; 1 year; Sec. C.
- Sapp, Joseph E., Tuckerton; ground Nos. 253-324-319-299; acreage, $33\frac{1}{4}$; \$33.25; June 20, 1916; 1 year; Sec. C.
- Sapp, H. W., Tuckerton; ground No. 315; acreage, $18\frac{1}{4}$; \$18.25; June 20, 1916; 1 year; Sec. C.
- Sapp, Walter L., Tuckerton; ground Nos. 292-298-297-320-318-321-347; acreage, $54\frac{1}{4}$; \$54.75; June 20, 1916; 1 year; Sec. C.
- Sprague, Joel H., Beach Haven; ground Nos. 427-287-275; acreage, $18\frac{1}{4}$; \$18.75; June 20, 1916; 1 year; Secs. C and D.
- Sprague, Samuel C., Barnegat; ground No. 39; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. F.
- Sprague, Henry, West Creek; ground No. 716; acreage, $1\frac{1}{4}$; \$1.50; June 20, 1916; 1 year; Sec. E.
- Sprague, Reuben, Est., West Creek; ground No. 648; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. E.
- Sprague, Frank, West Creek; ground Nos. 694-734; acreage, $2\frac{1}{4}$; \$2.75; June 20, 1916; 1 year; Sec. E.
- Sprague, P. R., West Creek; ground Nos. 618-655-683-727; acreage, $7\frac{1}{4}$; \$7.50; June 20, 1916; 1 year; Sec. E.
- Seaman, William S., West Creek; ground Nos. 659-688-740; acreage, $5\frac{1}{4}$; \$5.25; June 20, 1916; 1 year; Sec. E.
- Seaman, C. A., West Creek; ground Nos. 632-686-729; acreage, $7\frac{1}{4}$; \$7.25; June 20, 1916; 1 year; Sec. E.
- Seaman, George A., West Creek; ground Nos. 489-631-698; acreage, 23; \$23.00; June 20, 1916; 1 year; Sec. E.
- Shinn, Harry S., West Creek; ground Nos. 447-492-494-502-601-620-663-721; acreage, $22\frac{1}{4}$; \$22.25; June 20, 1916; 1 year; Secs. D and E.
- Shinn, Edward L., West Creek; ground Nos. 439-446; acreage, $15\frac{1}{4}$; \$15.50; June 20, 1916; 1 year; Sec. D.
- Shinn, Thomas, West Creek; ground No. 490; acreage, $2\frac{1}{4}$; \$2.50; June 20, 1916; 1 year; Sec. D.
- Shinn, Selah, West Creek; ground Nos. 545-469; acreage, $3\frac{1}{4}$; \$3.50; June 20, 1916; 1 year; Sec. D.
- Salmons, Frank, Staffordville; ground No. 739; acreage, $1\frac{1}{4}$; \$1.50; June 20, 1916; 1 year; Sec. E.
- Soper, Chas. H., Barnegat; ground Nos. 9-56-33; acreage, $10\frac{1}{4}$; \$10.50; June 20, 1916; 1 year; Sec. F.

- Sooy, Daniel T., New Gretna; ground Nos. 98-107; acreage, 9%; \$9.75; June 20, 1916; 1 year; Sec. A.
- Speck, James H., & Bro., Tuckerton; ground No. 138; acreage, 111; \$111.00; June 20, 1916; 1 year; Sec. B.
- Speck, James H., Tuckerton; ground No. 184; acreage, 7; \$7.00; June 20, 1916; 1 year; Sec. B.
- Speck, Harold, Tuckerton; ground Nos. 183-186; acreage, 15%; \$15.75; June 20, 1916; 1 year; Sec. B.
- Stiles, Ezra, & Co., Tuckerton; ground Nos. 221-236-288-256-252-257; acreage, 20%; \$20.25; June 20, 1916; 1 year; Sec. C.
- Stiles, James, Jr., Tuckerton; ground No. 219; acreage, 1%; \$1.25; June 20, 1916; 1 year; Sec. C.
- Stiles, Elias, Tuckerton; ground No. 311; acreage, 10%; \$10.50; June 20, 1916; 1 year; Sec. C.
- Smith, Ivo, Tuckerton; ground Nos. 205-245; acreage, 4%; \$4.75; June 20, 1916; 1 year; Sec. C.
- Smith, I. P., Tuckerton; ground No. 313; acreage, 7; \$7.00; June 20, 1916; 1 year; Sec. C.
- Smith, Ernest, & Bro., Tuckerton; ground No. 274; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. C.
- Sprague, Edward, Manahawkin; ground Nos. 722-778-779; acreage, 9; \$9.00; June 20, 1916; 1 year.
- Soper, Philip, Manahawkin; ground Nos. 227-716-718-742; acreage, 10%; \$10.25; June 20, 1916; 1 year.
- Shafto, Fred, Manahawkin; ground No. 737; acreage, 5%; \$5.50; June 20, 1916; 1 year.
- Truex, Isaac, Cedar Run; ground No. 10; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. E.
- Truex, George, Cedar Run; ground No. 809; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. E.
- Wilson, Amasa, Port Republic; ground No. 161; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. B.
- Wilson, Geo. W., Port Republic; ground No. 179; acreage, 2%; \$2.50; June 20, 1916; 1 year; Sec. B.
- Wilson, John H., Port Republic; ground No. 153; acreage, 2%; \$2.75; June 20, 1916; 1 year; Sec. B.
- White, Adelbert, Tuckerton; ground No. 308; acreage, 3%; \$3.75; June 20, 1916; 1 year; Sec. C.
- White, David M., Manahawkin; ground No. X, acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. F.
- West Creek Oyster Co., West Creek; ground No. X; acreage, 100; \$100.00; June 20, 1916; 1 year; Sec. F.

Division of Atlantic County.

PLANTING GROUNDS.

- Allen, James H., Ocean City; No. 154; acreage, 2.99; \$3.00; June 20, 1916; 1 year; Sec. B. 443-445.
- Collins, Burriss, Pleasantville; No. 164; acreage, 3.58; \$3.75; June 20, 1916; 1 year; Sec. D. 706-735.
- Cramer, I. L., Atlantic City; No. 47; acreage, 4.18; \$4.25; June 20, 1916; 1 year; Sec. A. 260-284-267-270.
- Chew, Benjamin, New Gretna; No. 49; acreage, 9.75; \$9.75; June 20, 1916; 1 year; Sec. A. 202-203-204-290.
- Conover, Elias, Port Republic; No. 54; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. A. 303.
- Cavileer, John D., Port Republic; No. 55; acreage, 1.50; \$1.50; June 20, 1916; 1 year; Sec. A. 237.
- Carney, George, Green Bank; No. 63; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. A. 228.
- Conover, James, Absecon; No. 103; acreage, 1; \$1.00; June 20, 1916; 1 year; Sec. C. 605.
- Cramer, Arnold, New Gretna; No. 115; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. A. 213-214-215; Sec. B. 406-449.

- Cramer, Gertrude, New Gretna; No. 117; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. B. 413.
- Cramer, Earl, New Gretna; No. 116; acreage, 9.85; \$10.00; June 20, 1916; 1 year; Sec. B. 414-427-438-442.
- Conover, Lillian, Atlantic City; No. 140; acreage, 8.00; \$8.00; June 20, 1916; 1 year; Sec. B. 463-464.
- Conover, John F., Atlantic City; No. 141; acreage, 2.00; \$2.00; June 20, 1916; 1 year; Sec. B. 469.
- Conover, Alfred, Atlantic City; No. 152; acreage, 7.00; \$7.00; June 20, 1916; 1 year; Sec. B. 474.
- Conover, William, Atlantic City; No. 157; acreage, 9.00; \$9.00; June 20, 1916; 1 year; Sec. B. 473-458.
- Doughty, Bertha I., Absecon; No. 163; acreage, 7.73; \$7.75; June 20, 1916; 1 year; Sec. C. 558.
- Dennls, Charles, Scullville; No. 157; acreage, 2.00; \$2.00; June 20, 1916; 1 year; Sec. D. 709.
- Dennls, Burris F., Scullville; No. 98; acreage, 2.50; \$2.50; June 20, 1916; 1 year; Sec. D. 740.
- Doughty, Edward, Oceanville; No. 107; acreage, .55; \$1.00; June 20, 1916; 1 year; Sec. C. 568.
- Darby, John W., New Gretna; No. 77; acreage, 2.00; \$2.00; June 20, 1916; 1 year; Sec. A. 209.
- Gray, John, New Gretna; No. 51; acreage, 4.84; \$5.00; June 20, 1916; 1 year; Sec. A. 227.
- Gaskill, Jesse and Henry, New Gretna; No. 118; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. A. 233.
- Gaskill, Thomas J., & Son, New Gretna; No. 139; acreage, 1.50; \$1.50; June 20, 1916; 1 year; Sec. A. 211.
- Griffith, Lewis, Absecon; No. 108; acreage, .80; \$1.00; June 20, 1916; 1 year; Sec. C. 604.
- Giberson, Mary, Absecon; No. 110; acreage, 1.98; \$2.00; June 20, 1916; 1 year; Sec. B. 435-441.
- Giberson, Samuel, Absecon; No. 111; acreage, 9.78; \$10.00; June 20, 1916; 1 year; Sec. C. 509-510-525.
- Giberson, Richard, Absecon; No. 112; acreage, 9.82; \$10.00; June 20, 1916; 1 year; Sec. B. 426-432; Sec. C. 503-507-508-601-607.
- Giberson, Enoch, Absecon; No. 123; acreage, 8.88; \$9.00; June 20, 1916; 1 year; Sec. C. 511-515-520-599.
- Giberson, Chester, New Gretna; No. 139; acreage, 1.50; \$1.50; June 20, 1916; 1 year; Sec. A. 246-276.
- Horton, John, Pleasantville; No. 100; acreage, .93; \$1.00; June 20, 1916; 1 year; Sec. D. 748.
- Horton, Charles, Pleasantville; No. 101; acreage, 5.72; \$5.75; June 20, 1916; 1 year; Sec. D. 713-751.
- Helfrich, Joseph, Pleasantville; No. 151; acreage, 3.30; \$3.50; June 20, 1916; 1 year; Sec. D. 714.
- Hammell, Frank, Absecon; No. 113; acreage, 1.50; \$1.50; June 20, 1916; 1 year; Sec. C. 598.
- Hammell, C. Pitman, Absecon; No. 143; acreage, 9.24; \$9.25; June 20, 1916; 1 year; Sec. C. 600-603-608.
- Hammell, Elnora, Absecon; No. 144; acreage, 2.95; \$3.00; June 20, 1916; 1 year; Sec. C. 530-560.
- Hackney, Stephen, Margate City; No. 128; acreage, 1.50; \$1.50; June 20, 1916; 1 year; Sec. D. 789.
- Holdskom, Samuel E., Longport; No. 129; acreage, 2.16; \$2.25; June 20, 1916; 1 year; Sec. B. 423.
- Higbee, James, Leeds Point; No. 43; acreage, 5.22; \$5.25; June 20, 1916; 1 year; Sec. A. 253.
- Higbee, Allen C., Leeds Point; No. 44; acreage, 4.90; \$5.00; June 20, 1916; 1 year; Sec. A. 252.
- Higbee, John, Leeds Point; No. 45; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. A. 250.
- Higbee, Fred, Leeds Point; No. 46; acreage, 8.64; \$8.75; June 20, 1916; 1 year; Sec. A. 294.
- Hewitt, Nelson, Port Republic; No. 81; acreage, 1.85; \$2.00; June 20, 1916; 1 year; Sec. A. 244.
- Hackett, Frank, Linwood; No. 94; acreage, 8.06; \$8.25; June 20, 1916; 1 year; Sec. D. 758-759-762.
- Holdskom, Harry P., Brigantine; No. 80; acreage, 1.00; \$1.00; June 20, 1916; 1 year; Sec. B. 420.
- Holdskom, William, Brigantine; No. 82; acreage, 3.00; \$3.00; June 20, 1916; 1 year; Sec. B. 415.

BOARD OF SHELL FISHERIES.

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- Holdzkom, Edward, Brigantine; No. 93; acreage, 5.95; \$6.00; June 20, 1916; 1 year; Sec. B, 416-417-428-419-425.
- Horton, Howard, Pleasantville; No. 85; acreage, 8.70; \$8.75; June 20, 1916; 1 year; Sec. D, 712-727-752.
- Horton, Robert, Pleasantville; No. 86; acreage, 2.16; \$2.25; June 20, 1916; 1 year; Sec. D, 716.
- Horton, Peter, Pleasantville; No. 87; acreage, 5.30; \$5.50; June 20, 1916; 1 year; Sec. D, 749-750.
- Hilton, John M., Pleasantville; No. 95; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. D, 787.
- Hilton, Hannah, Pleasantville; No. 96; acreage, 7.92; \$8.00; June 20, 1916; 1 year; Sec. D, 788-715-783.
- Horton, Willis, Pleasantville; No. 97; acreage, 6.06; \$6.25; June 20, 1916; 1 year; Sec. D, 720-726.
- Irving, Albert, Atlantic City; No. 64; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. B, 469.
- Jacobson, Charles, Oceanville; No. 167; acreage, .98; \$1.00; June 20, 1916; 1 year; Sec. C, 562-570.
- Kester, A. V., Somers Point; No. 89; acreage, 5.90; \$6.00; June 20, 1916; 1 year; Sec. D, 781.
- Lafferty, Walter, Pleasantville; No. 149; acreage, 9.00; June 20, 1916; 1 year; Sec. D, 710-754.
- Lind, William, Brigantine; No. 119; acreage, 1.50; \$1.50; June 20, 1916; 1 year; Sec. B, 431.
- Leeds, Thurman, Oceanville; No. 106; acreage, 2.50; \$2.50; June 20, 1916; 1 year; Sec. C, 542.
- Leeds, Wilmer, Oceanville; No. 104; acreage, 2.99; \$3.00; June 20, 1916; 1 year; Sec. C, 506-539.
- Leeds, L. N., Leeds Point; No. 92; acreage, 1.73; \$1.75; June 20, 1916; 1 year; Sec. A, 242.
- Leeds, Albert, Leeds Point; No. 57; acreage, 4; \$4.00; June 20, 1916; 1 year; Sec. A, 300.
- Loveland, Benj. F., New Gretna; No. 49; acreage, 3.35; \$3.50; June 20, 1916; 1 year; Sec. A, 206.
- Leeds & Doughty, Oceanville; No. 105; acreage, \$3.69; \$8.75; June 20, 1916; 1 year; Sec. C, 538-540.
- Lloyd, Raymond C., Sculville; No. 59; acreage, 1.18; \$1.25; June 20, 1916; 1 year; Sec. F, 163.
- Lloyd, Walter J., Sculville; No. 58; acreage, 10; \$10.00; June 20, 1916; 1 year; Sec. F, 152.
- Mathew, D. L., Oceanville; No. 160; acreage, 6; \$6.00; June 20, 1916; 1 year; Sec. C, 543-545-554-555-578.
- Mathis, Pitman E., New Gretna; No. 40; acreage, 1.11; \$1.25; June 20, 1916; 1 year; Sec. A, 207.
- Mathis, Thomas, New Gretna; No. 50; acreage, 9.40; \$9.50; June 20, 1916; 1 year; Sec. A, 235.
- Mathis, Alvin, New Gretna; No. 52; acreage, 6.34; \$6.50; June 20, 1916; 1 year; Sec. A, 205-301.
- Mathis, Mrs. Lois, New Gretna; No. 124; acreage, 3.50; \$3.50; June 20, 1916; 1 year; Sec. A, 249-296.
- Mitchell, William, Pleasantville; No. 114; acreage, 2.80; \$3.00; June 20, 1916; 1 year; Sec. D, 729-731.
- Nickols, Leon, Sculville; No. 71; acreage, 5.65; \$5.75; June 20, 1916; 1 year; Sec. F, 160.
- Nelson, Isaac, Absecon; No. 109; acreage, .75; \$1.00; June 20, 1916; 1 year; Sec. C, 596.
- Price, Job C., Atlantic City; No. 68; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. B, 424-452.
- Powers, Elwood M., Linwood; No. 121; acreage, 3.50; \$3.50; June 20, 1916; 1 year; Sec. D, 771.
- Robbins, Chas. and L. Dow, New Gretna; No. 41; acreage, 9.54; \$9.75; June 20, 1916; 1 year; Sec. A, 231.
- Robbins, L. Dow, New Gretna; No. 42; acreage, 3.85; \$4.00; June 20, 1916; 1 year; Sec. A, 201-217.
- Risley, Ephraim, Pleasantville; No. 133; acreage, 3; \$3.00; June 20, 1916; 1 year; Sec. D, 717.
- Risley, Obediah, Pleasantville; No. 147; acreage, 3.06; \$3.25; June 20, 1916; 1 year; Sec. D, 711.
- Somers, Leon, Linwood; No. 88; acreage, 9.45; \$9.50; June 20, 1916; 1 year; Sec. D, 766-769-773.
- Scul, John B., Linwood; No. 70; acreage, 2.05; \$2.25; June 20, 1916; 1 year; Sec. D, 776-870.
- Somers, Harry C., Oceanville; No. 122; acreage, .91; \$1.00; June 20, 1916; 1 year; Sec. C, 576.

- Somers, Mark, Oceanville; No. 142; acreage, 1.00; \$1.00; June 20, 1916; 1 year; Sec. C, 575.
- Smith, Aaron R., Sculville; No. 60; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. F, 156.
- Smith, Abel W., Sculville; No. 72; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. F, 158.
- Smith, Japhet, Sculville; No. 74; acreage, 3.64; \$3.75; June 20, 1916; 1 year; Sec. F, 161.
- Smith, Theodore, Sculville; No. 78; acreage, 8.67; \$8.75; June 20, 1916; 1 year; Sec. F, 154-164.
- Smith, John H., Sculville; No. 79; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. F, 155.
- Somers, Jackson, Sculville; No. 84; acreage, 2.64; \$2.75; June 20, 1916; 1 year; Sec. F, 162.
- Scull, Martin V. B., Sculville; No. 73; acreage, 3.80; \$4.00; June 20, 1916; 1 year; Sec. F, 166.
- Scull, Elijah, Sculville; No. 75; acreage, 6.54; \$6.75; June 20, 1916; 1 year; Sec. F, 153.
- Thomas, Jesse, Sculville; No. 102; acreage, 4.15; \$4.25; June 20, 1916; 1 year; Sec. F, 159.
- Somers, C. Bodine, Oceanville; No. 90; acreage, 4.00; \$4.00; June 20, 1916; 1 year; Sec. C, 551-571-572-573.
- Smith, J. Frank, Brigantine; No. 138; acreage, 4.39; \$4.50; June 20, 1916; 1 year; Sec. B, 433-439-440.
- Sooy, Leonard, New Gretna; No. 165; acreage, 1.00; \$1.00; June 20, 1916; 1 year; Sec. A, 200.
- Sooy, Elphra, Pleasantville; No. 125; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. D, 700.
- Sooy, Nancy, Pleasantville; No. 126; acreage, 4.50; \$4.50; June 20, 1916; 1 year; Sec. D, 785.
- Scull, Thomas, Leeds Point; No. 53; acreage, 5.90; \$5.50; June 20, 1916; 1 year; Sec. A, 245-273.
- Scull, Alfred S., Linwood; No. 69; acreage, .84; \$1.00; June 20, 1916; 1 year; Sec. D, 774.
- Sooy, Watson, Green Bank; No. 61; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. A, 229.
- Sooy Oyster Co., Atlantic City; No. 62; acreage, 10.00; \$10.00; June 20, 1916; 1 year; Sec. A, 230.
- Steelman, Chas. E. C., Somers Point; No. 83; acreage, 5.00; \$5.00; June 20, 1916; 1 year; Sec. D, 788.
- York, William, Pleasantville; No. 137; acreage, 2.50; \$2.50; June 20, 1916; 1 year; Sec. D, 786.
- Wilson, Benjamin, Port Republic; No. 159; acreage, 2.00; \$2.00; June 20, 1916; 1 year; Sec. A, 225.
- Weber, Nellie, Atlantic City; No. 66; acreage, 9.35; \$9.50; June 20, 1916; 1 year; Sec. B, 467-468.
- Weber, Edward A., Atlantic City; No. 65; acreage, 9.13; \$9.25; June 20, 1916; 1 year; Sec. A, 206-291-292-293; Sec. B, 470.

PROPAGATING GROUNDS.

- Babcock, William, Sculville; No. 19; acreage, 8; \$6.00; June 20, 1916; 1 year; Sec. E, 106.
- Doughty, F. F., Absecon; No. 32; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 25.
- Dennis, William B., Sculville; No. 37; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 113.
- Dennis, Georgetta, Sculville; No. 12; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 24.
- Dennis, Henry B., Sculville; No. 11; acreage, 4.45; \$9.00; June 20, 1916; 1 year; Sec. E, 43.
- Dennis, Burris F., Sculville; No. 10; acreage, 30.87; \$62.00; June 20, 1916; 1 year; Sec. E, 8-9-18-35-36-40-41.
- English, Walter, English Creek; No. 67; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 48.
- Garrison, Dennis, Sculville; No. 26; acreage, 2; \$4.00; June 20, 1916; 1 year; Sec. E, 15.
- Horton, Howard, Pleasantville; No. 30; acreage, 4.12; \$8.50; June 20, 1916; 1 year; Sec. E, 115.
- Hamilton, Thomas J., Absecon; No. 22; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 56.
- Hickman, Smith, Sculville; No. 21; acreage, 2; \$4.00; June 20, 1916; 1 year; Sec. E, 105.
- Jeffers, Benjamin, Sculville; No. 17; acreage, 4; \$8.00; June 20, 1916; 1 year; Sec. E, 2.
- Jeffers, Andrew, Est., Atlantic City; No. 29; acreage, 4.50; \$9.00; June 20, 1916; 1 year; Sec. E, 3.
- Jeffers, Geo. B., Sculville; No. 9; acreage, 6.50; \$13.00; June 20, 1916; 1 year; Sec. E, 4-5.
- Lloyd, Raymond C., Sculville; No. 76; acreage, 4.30; \$9.00; June 20, 1916; 1 year; Sec. E, 125.

- Lloyd, Walter C., Sculville; No. 16; acreage, 4.16; \$8.50; June 20, 1916; 1 year; Sec. E, 38.
 Lashley, Clarence, Sculville; No. 18; acreage, 2; \$4.00; June 20, 1916; 1 year; Sec. E, 109.
 Maple, Newton J., Atlantic City; No. 33; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 22.
 Nickols, Leon, Sculville; No. 4; acreage, 2; \$4.00; June 20, 1916; 1 year; Sec. E, 212.
 Nelson, Alexander, Atlantic City; No. 14; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 27.
 Steelman, Israel J., Sculville; No. 99; acreage, 2; \$4.00; June 20, 1916; 1 year; Sec. E, 127.
 Smith, Abel W., Sculville; No. 1; acreage, 10.61; \$20.50; June 20, 1916; 1 year; Sec. E, 101-103-119.
 Scull, Elijah, Sculville; No. 2; acreage, 3; \$6.00; June 20, 1916; 1 year; Sec. E, 19.
 Steelman, Enos, Sculville; No. 3; acreage, 2; \$4.00; June 20, 1916; 1 year; Sec. E, 44.
 Smith, John H., Sculville; No. 5; acreage 6.50; \$13.00; June 20, 1916; 1 year; Sec. E, 45-62.
 Steelman, Elmer, Sculville; No. 56; acreage, 2; \$4.00; June 20, 1916; 1 year; Sec. E, 14-16.
 Smith, Aaron R., Sculville; No. 6; acreage, 3.50; \$7.00; June 20, 1916; 1 year; Sec. E, 42.
 Somers, Boice, Sr., Sculville; No. 7; acreage, 3.75; \$7.50; June 20, 1916; 1 year; Sec. E, 104.
 Smith, Theodore, Sculville; No. 8; acreage, 4.00; \$8.00; June 20, 1916; 1 year; Sec. E, 112.
 Sampson, H. L., Sculville; No. 20; acreage, 2; \$4.00; June 20, 1916; 1 year; Sec. E, 108.
 Somers, Richard J., Linwood; No. 24; acreage, 4.97; \$10.00; June 20, 1916; 1 year; Sec. E, 114.
 Smith, John A., and Smith, Theodore, Sculville; No. 25; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 116-117-118.
 Thomas, Jesse, Sculville; No. 27; acreage, 3; \$6.00; June 20, 1916; 1 year; Sec. E, 206.
 Tellman, Eugene, Sculville; No. 15; acreage, 5.09; \$10.50; June 20, 1916; 1 year; Sec. E, 6-7.
 Willetts, Fred. W., Atlantic City. No. 35; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 23.
 Wilson, Lilliam R., Atlantic City; No. 36; acreage, 5; \$10.00; June 20, 1916; 1 year; Sec. E, 21.

BARITAN BAY.

- De Groff, William, Keyport; No. 1; acreage, 57¼; \$57.50; June 20, 1916; 1 year; ground Nos. 1-3.
 Hammer & Hammer, Keyport; No. 2, acreage, 42¼; \$42.25; June 20, 1916; 1 year; ground Nos. 4-5-25.
 Mason, John W., Keyport; No. 5; acreage, 17%; \$17.75; June 20, 1916; 1 year; ground No. 14.
 Maurer, William, Keyport; No. 7; acreage, 81½; \$81.50; June 20, 1916; 1 year; ground Nos. 37-38-41-42-43-68-9-8.
 Post, Frederick E., Keyport; No. 8; acreage, 6¼; \$6.50; June 20, 1916; 1 year; ground No. 51.
 Post, Russell B., Keyport; No. 3; acreage, 107%; \$107.75; June 20, 1916; 1 year; ground Nos. 45-47-48-18-83-52.
 Woolley, Wm. B., Keyport; No. 4; acreage, 92%; \$92.75; June 20, 1916; 1 year; ground Nos. 16-17-27-31-32-33.

SHARK RIVER DISTRICT.

- Algor, Devine, Como; ground Nos. 11-178-137-138-130-125-134-133-124-126-117-190-109-110-118; acreage, 15; \$21.75; June 20, 1916; 1 year.
 Bennett, Garrett, Avon; ground Nos. 160-169-104; acreage, 5; \$5.71; June 20, 1916; 1 year.
 Bennett, Henry A., Avon; ground Nos. 18-6-7-12; acreage, 4; \$13.70; June 20, 1916; 1 year.
 Bennett, Franklin E., Avon; ground Nos. 21-22-23-24-4-5-47-48; acreage, 8; \$21.36; June 20, 1916; 1 year.
 Bennett, John H., Belmar; ground Nos. 66-67-68-69-70-71-72-73-82-83-84; acreage, 11; \$6.28; June 20, 1916; 1 year.
 Brown, Charles, Belmar; ground No. 36; acreage, 1; \$1.14; June 20, 1916; 1 year.
 Brown, Harry, Belmar; ground Nos. 7-8; acreage, 2; \$2.28; June 20, 1916; 1 year.

- Bloodgood, Willets, Belmar; ground Nos. 23-24-25; acreage, 3; \$3.71; June 20, 1916; 1 year.
- Flemming, Harry H., Avon; ground Nos. 19-13-64-65-74-75-80-81-88; acreage, 9; \$10.35; June 20, 1916; 1 year.
- Gassin, Charles, Belmar; ground No. 33; acreage, 1; \$1.14; June 20, 1916; 1 year.
- Hoffman, Howard, Belmar; ground No. 34; acreage, 1; \$2.28; June 20, 1916; 1 year.
- Howland, Mrs. Chas., Belmar; ground No. 159; acreage, 2; \$2.28; June 20, 1916; 1 year.
- Morris, Wm. F., Asbury Park; ground Nos. 8-9-10-11-14-20; acreage, 6; \$18.25; June 20, 1916; 1 year.
- Morris, Alexander, Avon; ground Nos. 15-16; acreage, 2; \$6.84; June 20, 1916; 1 year.
- Newman, Wilson L., Belmar; ground Nos. 186-187-188-189-12-17-29-30-45-152-157-158-136-4-5-154-155-156-153-116-111-112-163-164-129-120-143-144-141-142; acreage, 36; \$48.42; June 20, 1916; 1 year.
- Newman, Charles, Belmar; ground Nos. 181-182-183-184; acreage, 4; \$6.84; June 20, 1916; 1 year.
- Palmer, John P., Asbury Park; ground Nos. 58-59-49-60; acreage, 4; \$2.50; June 20, 1916; 1 year.
- Palmer, Chas. H., Avon; ground Nos. 30-31; acreage, 2; \$3.42; June 20, 1916; 1 year.
- Slocum, John H., Avon; ground Nos. 117-118; acreage, 4; \$4.56; June 20, 1916; 1 year.
- Smock, John C., Avon; ground No. 38; acreage, 1; \$1.14; June 20, 1916; 1 year.
- Smock, Uriah, Avon; ground Nos. 32-34-35-36; acreage, 4; \$4.56; June 20, 1916; 1 year.
- Tucker, Edwin, Avon; ground Nos. 1-2; acreage, 2; \$2.28; June 20, 1916; 1 year.
- Vanote, F. H., Asbury Park; ground Nos. 25-26; acreage, 2; \$3.71; June 20, 1916; 1 year.
- Wright, James, Lakewood; ground No. 35; acreage, 1; \$3.00; June 20, 1916; 1 year.
- Wilson & Newman, Belmar; ground Nos. 119-121-122-123-180-1-131-132-139-141-161-162-167-168-170-171-172-175-176-177-27-69-26-20-19-18-15-14-13-10-69-128-127-114-113-28-28-31-32-37-38-39-40-41-41-42-42-43-44-54-55-56-57-58-59-60-61-62-63-64-65-66-68-70-71-72-73-74-75-76-77-78-79-80-81-81-82-83-84-86-87-88; acreage, 50; \$57.00; June 20, 1916; 1 year.
- Wooley, E. S. V., New Bedford; ground Nos. 149-150-151; acreage, 3; \$4.00; June 20, 1916; 1 year.
- Wooley, Hiram, New Bedford; ground No. 33; acreage, 1; \$1.50; June 20, 1916; 1 year.
- Wooley, William H., New Bedford; ground Nos. 179-146-147-53; acreage, 4; \$4.00; June 20, 1916; 1 year.

Document No. 40

ANNUAL REPORT
OF THE
Board of
Commissioners of Pilotage
OF THE
STATE OF NEW JERSEY
For the Year ending October 31st, 1916

ANNUAL

BOARD OF

OF THE

STATE OF NEW JERSEY

For Year ending October 31

1916

TRENTON, N. J.
MACCRELLISH & QUIGLEY CO., STATE PRINTERS.

1916.

October 31st, 1916.

Names.

Residence.

BENJAMIN VAN NOTE, <i>President</i> ,	Lakewood, N. J.
JOHN J. SCULLY, <i>Secretary</i> ,	South Amboy, N. J.
WILLIAM A. MAHER,	Hoboken, N. J.
JOHN PREDMORE,	Barnegat, N. J.
JOHN D. TOPPIN,	Newark, N. J.
JOHN W. BORDEN,	Little Silver, N. J.

REPORT

PERTH AMBOY, N. J., November 14th, 1916.

*To His Excellency, James F. Fielder, Governor, and to the
Legislature of the State of New Jersey:*

GENTLEMEN—The New Jersey Board of Commissioners of Pilotage respectfully presents herewith its annual report for the year ending October 31st, 1916:

The following pilots, having passed the age of sixty years, appeared before the board and made formal applications for an extension of their licenses: William Lewis, Wilmer Shields, Richard Behrens and John R. Hall. After successfully passing necessary examinations as to color, sight and hearing, extensions were granted.

Deputy Henry M. Clarke appeared before the board seeking a Full Branch license. Having fully satisfied the board as to length of service, ability and fitness, his application was granted. Deputy Pilots Samuel C. Veggs and Wm. A. Mitchell personally petitioned the board for an increase in their licenses. They proving worthy, the board granted the desired extension, making their licenses read for 28 feet draft. Deputy John L. Hall was granted an increase from an 18 feet to 24 feet draft license.

Apprentice Frank D. Wall presented himself to the board bearing recommendations from Executive Committee of Pilots' Association that an 18 feet draft license be granted him. He having satisfied the board as to length of service and ability, license was granted.

Too much praise cannot be lavished upon the pilot service for the capable and efficient manner in which they have handled over two thousand vessels in and out of the harbor of New York and bordering harbors during the past year, without one serious accident.

The annual joint meeting with the New York Board, on board

the Pilot SANDY HOOK, proved a mutually enjoyable trip, as matters pertaining to the cause of harbor lines, deeper waterways and improved harbor facilities were discussed.

We suffered the loss of our faithful president, John R. Dewar, by death during January, and by unanimous vote elected Mr. Benjamin VanNote to the presidency.

The board has at all times shown a lively interest in maritime matters, and appointed one of its members to assist in any way possible the municipal authorities of Newark in the work of establishing pierhead lines.

The usual annual tables are herewith appended.

Very respectfully submitted,

By order of the board,

JOHN J. SCULLY,

Secretary.

BENJ. VAN NOTE,

President.

Financial Statement.

1915.

November,	\$25,594 97
December,	22,374 27

1916.

January,	\$23,744 10
February,	22,222 18
March,	24,836 94
April,	23,511 94
May,	27,480 77
June,	27,253 35
July,	24,691 94
August,	25,125 25
September,	23,560 06
October,	21,135 20

Total,	\$291,530 97
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Kind and Number of Vessels Piloted.

INWARD.

1915.	<i>Steamers.</i>	<i>Ships.</i>	<i>Barks.</i>	<i>Brigs.</i>	<i>Schrs.</i>	<i>Total.</i>
November,	159	..	2	..	2	163
December,	142	..	2	..	3	147
1916.						
January,	158	..	3	..	6	167
February,	145	1	4	..	..	150
March,	159	..	1	..	3	163
April,	167	2	1	..	7	177
May,	183	1	3	..	5	192
June,	185	1	..	..	5	191
July,	170	2	10	..	11	193
August,	167	..	6	..	7	180
September,	141	2	4	..	3	150
October,	151	3	3	..	4	161
Totals,	1,927	12	39	..	56	2,034

OUTWARD.

<i>1915.</i>	<i>Steamers.</i>	<i>Ships.</i>	<i>Barks.</i>	<i>Brigs.</i>	<i>Schrs.</i>	<i>Total.</i>
November,	166	..	4	..	4	174
December,	142	1	2	..	9	154
<i>1916.</i>						
January,	155	1	3	..	4	163
February,	145	1	1	..	1	148
March,	108	1	2	..	5	176
April,	154	..	2	..	5	162
May,	191	2	2	..	8	203
June,	192	2	1	..	9	204
July,	159	1	2	..	5	167
August,	170	1	10	..	6	187
September,	169	2	4	..	10	185
October,	136	..	3	..	4	143
Totals,	1,947	12	36	..	71	2,066

Active Members.

Full Branch—John W. Ackerman, John A. Ashcraft, Allen M. Beebe, Alonzo M. Beebe, Charles Beebe, Howard E. Beebe, Richard Behrens, Richard Bigley, Marcus A. Carr, Henry M. Clarke, Stephen H. Cooper, Wm. Crocker, Wilmer J. Crocker, Chas. B. Devereaux, Wm. S. Devereaux, Albert L. Dexter, Walter D. Earle, Frank T. Egan, John R. Hall, Warren A. Hall, John F. Hopkins, Wm. J. Hurrell, Wm. B. Lennan, Wm. Lewis, Wm. A. Lowe, James E. McCarthy, John F. McCarthy, Edward P. Nichols, George Oldmixon, Leon E. Oldmixon, John Petersen, Wilmer Shields, Ernest H. Sloat, Nikolai A. Wall, Chas. E. J. Warner, Joseph S. Wells, Phillip E. Winters, Joseph A. Wood.

Deputies—S. C. Beggs (28), John L. Hall (24), Wm. A. Mitchell (28), Frank D. Hall (18).

Apprentices—Hilton Lowe, F. B. Lennan, James A. Melville.

Retired—J. D. M. Beebe, Thos. F. Burrett, Hiram Treat, Nathan Wood.

Document No. 41

R E P O R T
OF
BOARD OF COMMERCE
AND NAVIGATION

1916

STATE OF NEW JERSEY

Board of Commerce and Navigation

Report to the Legislature

on the

Operations of the Board

1916

J. SPENCER SMITH, *President*

RICHARD C. JENKINSON, *Vice-President*

W. PARKER RUNYON

JOHN M. WARD

WILLIAM L. SAUNDERS

J. WARD RICHARDSON

WILLIAM T. KIRK

ALLEN K. WHITE

B. F. CRESSON, JR., *Chief Engineer and Secretary*

JOHN C. PAYNE, *Asst. Chief Engineer*

HENRY J. SHERMAN, *Engineer Inland Waterways*

WILLIAM A. MAUPAY, *Inspector, " "*

E. F. FLOWERS, *Inspector of Power Vessels*

JANUARY, 1917

TRENTON, N. J.

MacCrellish & Quigley Co., State Printers,

1917

Annual Report for 1916.

GENERAL WORK OF THE BOARD.

The powers and duties of the Board were so fully set forth in the Board's report to the Legislature of 1915 that it is not necessary to further state them, but reference is here made to that report.

The activities of the Board, however, have increased to a very great extent; in all departments the work has expended, and public interest has been aroused not only by the activities of the Board in formulating plans and advising on matters of municipal development, but the commercial activities of the country have given an impetus to the development of the waterfront of New Jersey unprecedented in its history. The phenomenal amount, over half a million dollars, received during the year attests the truth of this statement. Also the examinations into the occupation of the waterfront of the State inaugurated by the Board have resulted in increased activity.

During the year forty-nine (49) grants, ten (10) leases, seventeen (17) licenses and seven (7) conversions were executed.

REAPPOINTMENT OF COMMISSIONERS.

Under the law the terms of Commissioners Allen K. White and William T. Kirk terminated on June 30th, 1916.

On March 6th, 1916, Governor Fielder submitted the names of these gentlemen for reappointment to the Board for a period of four years from July 1st, 1916. These appointments were promptly confirmed by the Senate.

BOARD MEETINGS.

Regular meetings of the Board have been held at Trenton on the following dates: January 3d, January 18th, February 15th, March 21st, April 17th, May 15th, June 19th, July 17th, August 21st, September 21st, October 16th and November 20th, 1916.

At these meetings persons having cases for consideration by the Board appear and present their cases, giving such informa-

tion as they desire, and as the Board may desire, in order to reach an understanding of the circumstances surrounding the cases.

After the cases in which applicants have made appearance have been disposed of, the calendar is taken up in the regular order of the cases, considered and acted upon. Cases needing legal advice are referred to the Attorney-General, or further examination as to facts or surveys are referred to Special Committees for examination, and reported at the next meeting of the Board.

MEETINGS OF COMMITTEE ON SALES AND LEASES OF RIPARIAN LANDS.

Meetings of the Committee have been held at Jersey City on the following dates: January 13th, February 10th, March 16th, April 13th, May 10th, June 15th, July 13th, August 17th, September 14th, October 11th and November 16th, 1916.

At these meetings applicants have appeared and presented their cases, and the Committee has reach conclusions which were embodied in the recommendations. These recommendations were made to the full Board at its regular meetings at Trenton, and either approved, or, upon discussion, referred for further consideration.

At the meeting of the Board held November 20th, 1916, it was decided to abandon the holding of meetings of the Committee on Sales and Leases of Riparian Lands, and to have such applications considered in executive session by the full Board before the regular monthly meeting, and such cases in which the conclusion could not be reached at that executive session to be referred to the Committee on Sales and Leases of Riparian Lands.

PERMITS ISSUED BY THE BOARD FOR WATER-FRONT IMPROVEMENTS.

Under the law it is necessary for persons contemplating any construction or work in connection with the development of the waterfront of the State to submit the plans for such construction or development to the Board. Upon approval of such plans permits are issued.

Seventy-seven (77) permits have been issued during the current year. Two applications for permits were refused.

This procedure results not only in the approval of such developments as are satisfactory to the Board, but it calls the attention of the persons who are interested in such developments to the necessity of acquiring the right of the State before pro-

ceeding with same, and furnishes a record in the department of the development of the waterfront of the State.

STATEMENT OF INVESTIGATIONS OF ILLEGAL OCCUPATION OF THE STATE'S LANDS UNDER WATER.

Occupations of tidal land in this State, not known to be covered by conveyances on record in this office, are made the subject of investigation by two investigators appointed in April and June, aided occasionally by other employees of the Board.

The important occupations thus examined under number 580, and the minor cases number 406.

At this dates 400 occupants have been notified to show their authority for such use; 154 have not answered; of the remainder, 43 have produced documents or given references to public records to prove title by grant, Freeholders' License or Meadow Banking Act; 18 have applied for rights covering their particular use and 15 express a desire to obtain riparian rights; the remaining cases are in process of adjustment.

In many of the documents produced the descriptions are so obscure as to necessitate elaborate searches of title to determine just what occupation is warranted.

A large amount of data is being assembled, which is becoming progressively valuable to all persons interested in the development of the waterfront of the State. The system of keeping the records is complete and shows the status of any case.

The investigation has an educational value, as many shore-front owners, depending on deeds, believe that their possession extends to low-water line, or even to the middle of certain navigable streams; others have occupied State lands illegally, not knowing permission to occupy was necessary.

A number of upland owners have erected small piers or boat houses for private uses without acquiring riparian rights. To secure the rights of the State without imposing any hardship on such occupants, the Board issues a Revocable License, authorizing such limited use, at the rate of five dollars (\$5.00) per year.

The form of Revocable License issued will be found in Appendix "D" of this report.

MAPS OF RIPARIAN LANDS AND CONVEYANCES.

A set of maps of the riparian lands and conveyances of the State has been commenced. These maps are necessary for several reasons; they give ready information concerning the

ownership of upland and land under water for use in locating conveyances already made and those which are applied for; they assist title companies in making searches which involve riparian conveyances; they form an index to the record books, and assist in the finding of purprestures; they put the records in convenient form for the use of the public, and multiply copies of them as a guard against their loss.

For making these maps, and for the increasing work of other kinds, the employment of additional draughtsmen was authorized at the meeting of the Board on March 21st, after which three were appointed, and on July 17th, when three more were added and an additional room secured.

The draughtsmen compile from the records of this office the Pierhead and Bulkhead Lines adopted, and the grants, leases and licenses issued by the Riparian Commission and by this Board, and plot them on the maps with the dimensions, date, record book and page, price per foot of frontage, total price, and, for leases, the annual rental.

They also compile from the records of the United States Government, counties, municipalities, railroads and private land owners, data for making a complete map of all the tracts bordering on tidal waters with the names of owners to date.

The maps are of the uniform size, 30" x 41", and are generally to a scale of 100 feet to 1 inch, but scales of 200 feet and 300 feet to 1 inch are occasionally used. Sixty-three of these maps have been completed, ten are completed excepting one or two items for which information is sought, and sixteen are under way. The territory covered by these ninety-one maps includes the Hudson River, from the New York State Line to Englewood Cliffs, and from Fort Lee to the mouth; all of New York Bay, the Kill Van Kull and Newark Bay, the lower seven miles of the Hackensack River and the lower six miles of the Passaic River, four miles of the north end and three miles of the south end of the Arthur Kill; and the Delaware River, from Fisher Point to Jefferson Street, Camden.

Three index maps have also been made.

These maps will be revised from time to time and the date of revision shown in the title.

Copies of the maps are kept in the Trenton and Jersey City offices and one is furnished to each Commissioner.

A sample of these riparian maps is attached to this report.

FREEHOLDERS' LICENSES.

The underlying idea in the passage of the Wharf Act of 1851, and the same is true of many of the direct legislative grants, was that a dock of specified dimensions and for needed and understood use and purpose was to be built and maintained; that the building and maintenance of this dock was in the nature of a contract, the lessee in return for the privilege or authority to build a dock, was to build it, and it was to run with the land and not be valid otherwise; indeed, Vice-Chancellor Backes, in the case between John W. Wescott, Attorney-General of the State of New Jersey, informant, and American Creosoting Company, defendant, stated: "The design of the act under consideration, to stimulate commercial navigation, and the legislative scheme imposing an obligation upon the licensee to build a dock, wharf or pier as consideration for the State's title, manifestly demands something more than the mere fencing in or enclosing the land by a line of poles."

The subject of the occupation of the State's lands by shore owners having licenses from the Board of Freeholders has occupied the attention of the Board, and has been the subject of adjudication by the courts; two important cases have been decided by the Court of Chancery in favor of the State.

Not only were licenses issued before the repeal of the Wharf Act in 1891, but a great many of the licenses issued within the time specified in the repeal of the Wharf Act have been the subject of objection by this Board. As has been stated above, the theory and principle involved in the issuing of a license by the freeholders was that there was a demand for a specific dock, of a given size and for a known use, and that the preliminaries looking to the granting of the license by the freeholders were clearly stated in the act, and the time within which such occupation should take place was stated and limited to five years; notwithstanding these provisions, which were in the interests of the shore owner and in the interests of the State, when the Wharf Act was repealed in 1891, shore owners in some of the riparian counties of the State, in haste, secured what purported to be freeholders' licenses for extensive frontages, in some instances as much as half a mile in length, on which flimsy constructions, in some cases simply a row of piling, was driven, with a string-piece attached, in order to attempt to comply with the provisions of the Wharf Act, and thereafter it was attempted to take possession of the State's lands without compensation and

without complying either with the letter or the spirit of the Wharf Act of 1851. In the cases of the Lucol Company these conditions obtained, and, after careful review, the Court of Chancery decided that such an occupation was not in compliance with the Wharf Act, and the title remained in the State, and the party so attempting to occupy was obliged to take out a grant from the State. See *Vice-Chancellor Emery in Stockton, Attorney-General vs. American Lucol Company*, 36 Atl. Rep. 572.

A more recent case is that of the American Creosoting Company, referred to above, who, under color of right by a freeholders' license issued a number of years ago, attempted to build and did build a substantial pile dock within a line of piling claimed to have been driven at the time of the license, to which a single string-piece had been attached. At the time of the freeholders' license in question a small dock was in existence, although extending beyond the line fixed by the Commissioners, and which was the line described in the freeholders' license. The Creosoting Company not only claimed the right to occupy the small dock in question, but also claimed the right to build a substantial, usable dock within the area, the outer line of which was indicated by this line of piling and string-piece. In the case as presented before Vice-Chancellor Backes, the claim was made and testimony was offered by the Creosoting Company to fortify the claim that the line of piling and string-piece was part of the dock which it had a license to build, and that the Company, or its predecessors in use, used the said line of piling to moor vessels to while they were awaiting access to the dock to be unloaded.

As to this claim on the part of the company that the line of piling was its idea of a dock, and had been so used, Vice-Chancellor Backes decided—referring to the Lucol case—that the case in question presented no differentiating factor from the Lucol case and that the theory of automatic enlargement was unsubstantial because, when the freeholders' license was granted, the licensee put in the piling “not for the purpose of extending the wharf.” “True, it may be” (the Vice-Chancellor says), “as the defendant says, that the pilings were used, and advantageously, for the mooring of boats preparatory to charging and discharging cargo, but the most that can be claimed on that score is that they furnish a convenience and facility for the work at the wharf, without being a constituent or essential part of it.” * * * “The spirit and meaning of the statute is that, within the time limited, a licensee shall have bona fide erected a ‘wharf,’ viz.: A space of ground artificially prepared for the reception of mer-

chandise from a ship or vessel, so as to promote the convenient loading and discharging of such vessel."

The Vice-Chancellor finds "the licensees not having in any sense met the requirements of the law, the defendant is adjudged guilty of purpresture in regard to the wharf built in 1911, and it will be ordered removed. So much of the old wharf maintained beyond the dock line, the illegality of which was not denied, will also be ordered removed. Costs to the State."

The following are the conclusions of the Vice-Chancellor:

Submitted April 5th, 1916. Decided April 12th, 1916.

IN CHANCERY OF NEW JERSEY.

BETWEEN

JOHN W. WESCOTT, ATTORNEY-
GENERAL OF THE STATE OF
NEW JERSEY,

Informant,

CONCLUSIONS.

AND

AMERICAN CREOSOTING COMPANY,
Defendant.

A license granted under the Wharf Act of 1851 (C. S. 5856) is not executed by the stringing of piles along the dock line on either side of, and tied to, a pre-existing wharf; and the land thus enclosed is not thereby vested in the licensee.

For the Informant, *John W. Wescott, Esq., Atty.-General.*
For the Defendant, *Mr. Francis Lafferty.*

BACKES, V. C.

This is an information by the Attorney-General, who seeks to have a wharf, erected by the defendant on the southerly shore of the Passaic River at Newark, declared a purpresture, and an injunction for its removal. The defendant claims the right to maintain the wharf under a license granted to its predecessor in title, Baeder and Adamson, by the Board of Freeholders of Essex, by virtue of the Wharf Act of 1851 (C. S. 5856), the fifth section of which provides that such license

"Shall authorize and empower the said applicant to erect the dock, wharf or pier at any time within five years from the date thereof; and said docks, wharves, or piers, or so much thereof as may be erected within

said five years, shall be vested in said shore owner, in the same manner, for the same estate, and with the same limitations over, in remainder or otherwise, as the lands along said tidewaters in front of which the same were made may be; and such license shall not be assignable, except with, and as appurtenant to said lands, and shall pass, by any sale of said lands, as appurtenant thereto."

The license was granted February 23d, 1876, and extended across the whole of the river front of the licensee's land, 891.65 feet, and into the river to the dock-line, fixed by a commission appointed for that purpose by the Legislature in 1872. Years before the license was obtained, Baeder and Adamson maintained a wharf on their property some 60 feet in width, reaching into the river a considerable distance beyond the after-established dock-line; but by what right, if any, is not disclosed. This wharf is still standing and in use by the defendant. Within the year of the grant, the licensees sunk piling along the dock-line the entire length of their property, 7 or 8 feet apart, joined together by 12-inch cap logs or stringers and fastened to the wharf on either side. Nothing else was done until 1911, when the defendant built another wharf, the one in question, immediately adjoining and westerly of the old one. By that time the string of cap logs and piling had disintegrated.

A single question is submitted for decision: Was the enclosure of the land by the row of piling and top pieces an execution of the license within the intent of the act above quoted, so as to divest the State of its land and vest it in the licensees? Such an enclosure, without more, was held by Vice-Chancellor Emery, in *Stockton, Attorney-General v. American Lucol Co.*, 36 Atl. Rep. 572, to be not a compliance with the terms of the grant. Assuming the doctrine of that case to be sound, defendant's counsel controverts its application to the present situation, because of the added feature here of the old wharf, of which, they contend, the row of piling and the connecting stringers, when erected, became an integral part and laterally expanded and spread it over the whole of the licensees' 800 feet and more of river front. The pre-existence of this wharf, it seems to me, affords no differentiating factor, inasmuch as the premises upon which the theory of automatic enlargement rests is unsubstantial, for the reason that when Baeder and Adamson got their license from the Freeholders, they put in the piling, not for the purpose of extending the wharf, but, as Mr. Adamson says, "to conform to the laws." Simulation—tying them by stringers to the wharf

was an economic measure, without thought or intent of being complementary of the statutory requisite; and, further, because the price of the State's lands was a practical and not an ideal compliance with the condition of the grant. True, it may be, as the defendant says, that the pilings were used and advantageously for the mooring of boats preparatory, to charging and discharging cargo, but the most that can be claimed on that score is that they furnish a convenience and facility for the work at the wharf, without being a constituent or essential part of it. I do not mean to indicate that the proprietary right acquired by a license erecting a wharf is confined to the area covered by the platform or floor-space of the structure, but my view is that the right is only coextensive with such immediate lateral fixtures necessary for its maintenance, and as are incidental to a full enjoyment of the privileges. The stretch of piling put in by the licensees to serve another purpose obviously does not come within this criterion. The design of the act under consideration, to stimulate commercial navigation, and the legislative scheme imposing an obligation upon the licensee to build a dock, wharf or pier as consideration for the State's title, manifestly demands something more than the mere fencing in or enclosing the land by a line of poles.

The spirit and meaning of the statute is that, within the time limited, a licensee shall have bona fide erected a "wharf," viz., a space of ground artificially prepared for the reception of merchandise from a ship or vessel, so as to promote the convenient loading and discharging of such vessel, Bouv. 3449, or build a "dock," viz., the slip or waterway extending between two piers or projecting wharfs for the reception of ships, sometimes including the piers themselves, Webster; in order to earn a concession, and that the land thus ceded was to be confined to the docks, wharf or pier proper. The preëmption by virtue of the license is not redeemed by a structure covering only a fractional portion of the grant.

The licensees not having in any sense met the requirements of the law, the defendant is adjudged guilty of purpresture in regard to the wharf built in 1911, and it will be ordered removed. So much of the old wharf maintained beyond the dock-line, the illegality of which was not denied, will also be ordered removed. Costs to the State.

It will be well for persons claiming under freeholders' license or legislative enactment to regard such licenses in the spirit of the law which authorizes their issuance, and there can be no doubt or question that the Legislature had in mind in passing

the Wharf Act of 1851 to facilitate the lawful construction of a wharf of such reasonable size and of such character as to meet the actual use for loading and unloading merchandise in actual transit at the time or in the five years of the issuing of such license, and the dicta of the judge above referred to is confirmatory of this view, that when the licensee failed to construct such a tangible and practicable wharf within the time fixed by the statute, his right ceased.

In connection with these extensive concessions attempted to be granted by the Freeholders in 1891, it is well to notice that no compensation is provided, and that the licenses would be faulty on this ground; that extensive and valuable frontages of the State's lands were diverted from the School Fund without compensation to the said School Fund, and without the reciprocal benefit of construction of docks or wharves for waterfront improvements, but were simply a subterfuge, and, in a way, a fraud on the School Fund of the State of New Jersey in that it alienated these extensive and valuable fronts from the State for the alleged purpose of development and allowed them to be held for speculative purposes for the future benefit entirely of the shore owner.

PROPOSED TERMINAL AT BAYONNE.

Under the law which created the New Jersey Harbor Commission, it was specifically stated that it would be the duty of the Board "to prepare and propose for such municipality a proper plan for the development and improvement of its waterfront upon any navigable stream, river or waters of this State, or bounding thereon, and it shall be the duty of the said Commission to prepare and submit such plan or plans for the improvement and development of the waterfront of such municipality," and acting under this section of the law, the Board of Commissioners of the City of Bayonne passed a resolution reading as follows:

WHEREAS, There is now under consideration the development of the New York Bay frontage of the City of Bayonne, in which this city is vitally interested; and

WHEREAS, The Board of Commerce and Navigation of the State of New Jersey, in conjunction with the United States Harbor Line Board, have control over the establishment of bulkhead and pierhead lines and the improvement of the channels necessary to the commercial use of said property; and

WHEREAS, This city desires to have the active co-operation of the said Board of Commerce and Naviga-

Proposed Marine Terminal and Industrial City on New York Bay at Bayonne, N. J. Planned by New Jersey State Board of Commerce and Navigation, B. F. Cresson, Jr., Chief Engineer. June, 1916.

tion in securing for the city the necessary action by, and assistance of, the United States authorities in the establishment of such harbor lines, and the dredging of channels to said property;

Be it resolved, That this Board of Commissioners of the City of Bayonne request the said Board of Commerce and Navigation to use its best offices to secure for the City of Bayonne an adequate channel to the New York Bay riparian property, lying south of the Jersey City line, and also to aid and advise this Commission in securing for the city adequate dock, warehouse and shipping facilities in this territory and for the purpose of meeting any proper expense in connection with such assistance, this Board has agreed to make an appropriation of sufficient money, not exceeding five thousand dollars, to pay for engineering and to other services which said Board of Commerce and Navigation may deem necessary to incur.

The Board considered this resolution at its meeting on June 19th, 1916, and directed its Chief Engineer to undertake the work asked for.

An office was established in Bayonne and a small staff of skilled engineers were retained and put at work on this project under the direction of the Chief Engineer.

Studies were prepared showing the relative advantages of this locality, of the types of construction in use in this locality, the latest practice in harbor layouts and constructional details in many of the Atlantic, Gulf and Pacific ports, and as careful a study was made as could be of the bottom conditions in this locality without going to the expense of making borings or driving test piles, and a report was prepared and is now in the hands of the printer covering **A PROPOSED MARINE TERMINAL AND INDUSTRIAL CITY ON NEW YORK BAY AT BAYONNE, NEW JERSEY.**

This report contains fourteen maps and plans and contains five plans and estimates of what are designated as possible Primary Installations, that is, what work might be carried on at first in order to make the terminal operative.

Detail estimates and recommendations are included in the report, and a cartoon was prepared showing a bird's-eye view of the proposed terminal, and this cartoon is reproduced in this report.

The City of Bayonne, out of its appropriation, has paid all the expenses of the engineering force, of the preparation of drawings and estimates, and of the writing of the report, and of

the printing of the report, but the services of the Chief Engineer of the Board have been rendered in this matter without cost or expense to Bayonne.

Several public meetings have been held in Bayonne at which this project has been discussed and which were attended and addressed by the president and members of the Board.

Mr. Irving T. Bush, president of the Bush Terminal Company, has interested himself greatly in this project, and has gone so far as to publicly state that if this project is carried out and if the City of Bayonne will acquire the lands and will make the necessary reclamation, and will construct the facilities necessary for the operation of such a terminal, that he will enter into a lease with the authorities of Bayonne under which he will undertake to operate this terminal for a long term of years, say fifty (50) years, and will pay to the city sums of money sufficient to pay the interest on the investment that the city may make, and will, in addition, set aside a sufficient sum of money for the retirement of the city bonds at the expiration of the lease; that he will make a large cash deposit as an evidence of his good faith, in addition to placing the credit of the Bush Terminal Company behind his guarantee. He has further stated that he will, in lieu of taxes, agree to share the profits accruing from the operation of this terminal with the City of Bayonne on the basis of a dollar for a dollar.

This, in effect, is the extension of public credit to create a terminal to be operated on a profit-sharing basis by an experienced private corporation.

PROPOSED TERMINAL AT CAMDEN.

Acting under the same section of the law, the Board of Harbor Commissioners of the City of Camden passed a resolution reading as follows:

WHEREAS, There is now under consideration the development of the Delaware River frontage of the City of Camden, in which this city is vitally interested; and

WHEREAS, The Board of Commerce and Navigation of the State of New Jersey, in conjunction with the United States Harbor Line Board, have control over the establishment of bulkhead and pierhead lines and the improvement of the channels necessary to the commercial use of said property; and

WHEREAS, This city desires to have the active co-operation of the said Board of Commerce and Naviga-

tion in securing for this city the necessary action by, and assistance of, the United States authorities in the establishment of such harbor lines, and the dredging of channels to said property, and in the general development of Camden's waterfront;

Be it resolved, That this Board of Harbor Commissioners of the City of Camden requests the said Board of Commerce and Navigation of the State of New Jersey to use its best offices to secure for the City of Camden an adequate channel for its Delaware River frontage, and also to aid and advise this Commission in securing for this city adequate dock, warehouse and shipping facilities, and to co-operate with this Commission in the preparation of a general development plan for the City of Camden's waterfront, and to this end that we request the said Board of Commerce and Navigation to permit its Chief Engineer to undertake the general and direct supervision of the perfection of such a plan; and

Be it further resolved, That for the purpose of meeting any proper expenses in connection with such cooperation and assistance, this Board hereby appropriates and sets apart a sum of money not exceeding two thousand dollars to pay for the necessary engineering and other expenses properly connected with said plan, which said Board of Commerce and Navigation or its Chief Engineer may deem necessary to incur.

The Board considered this resolution at its meeting on June 19th, 1916, and directed its Chief Engineer to undertake the work asked for.

The Board of Harbor Commissioners gave the services of its Secretary and its Engineer, and employed an additional draughtsman to work generally under the direction of the Chief Engineer of the Board of Commerce and Navigation, in the matter of the preparation of plans and a report.

Three studies were made to show the industrial situation in Camden, the railroad and transportation situation, and the occupation of the waterfront, and the Secretary of the Harbor Board sent out to manufacturers a questionnaire prepared by the Chief Engineer of the Board. This questionnaire asked details of the industries which would aid in the consideration of the problem.

President Smith, Vice-President Jenkinson and Commissioner Kirk appeared before the officials of the City of Camden and the Board of Harbor Commissioners of Camden on December 4th,

at which time the Chief Engineer presented a report containing a detailed plan and recommendation for the development of the Spruce Street property in Camden. Thus, it was stated, is only a partial study of the Camden development plan, but it includes the most important piece of property owned by the City of Camden, and will work into a general port plan.

This report, which contained two detailed drawings and a cartoon showing a bird's eye view of the proposed improvement, is now in the hands of the printer, and will be sent to the manufacturers of Camden and to its important citizens, preliminary to holding a general public meeting. A photograph of the cartoon is attached to this report.

The City of Camden, out of its appropriation, has paid all the expenses of the engineering force, of the preparation of drawings and estimates, of the writing of the report and of the printing of the report, but the services of the Chief Engineer of the Board have been rendered in this matter without cost or expense to Camden.

INLAND WATERWAYS.

Further dredging on the construction of the Inland Waterway was done during the past year under two contracts with the Hill Dredging Company in Upper Barnegat Bay. The first one, situated below Mantoloking, was finished on July 15th, 1916. 17,603 cubic yards were dredged at twenty-two and one-half cents (\$0.22½) per cubic yard, amounting to \$3,960.68. The total distance covered was 3,788 lineal feet.

The other contract, which was for the last section of the Inland Waterway, was completed on September 26th, just past. Under this final contract 44,311 cubic yards were removed in Upper Barnegat Bay, near Mantoloking. The unit price was twenty-three and one-half cents (\$0.23½), making a total cost of \$10,413.08.

As this marks the completion of the dredging of the Inland Waterway from Cape May to Bay Head, some figures concerning the project may be of interest. The construction work was begun September 12th, 1908, and completed September 26th, 1916, a period of about eight years. The length from Cold Spring Inlet, Cape May, to the Railroad Bridge at Bay Head (the original northern terminus) is 114.7 miles, which point is 0.37 miles north of the entrance to the Bay Head-Manasquan Canal. The total distance dredged is 31.25 miles, leaving 83.45 miles where no dredging was required to comply with the act of the Legislature.

Proposed Marine Terminal and Waterside Warehouses at Spruce Street on the Delaware River. B. F. Cresson, Jr., Engineer. November, 1910.
State Board of Commerce and Navigation.

The whole quantity dredged was 3,075,064 cubic yards, costing \$328,625.38, an average of 10.69 cents per cubic yard. The lowest unit price paid was \$0.07, and the highest price \$0.23½. In Little Egg Harbor Bay, opposite Little Sheepshead Thoro-fare and near Mile 67, the greatest depth of water was found. Here the lead line showed 43 feet at mean low water. Twenty-six draw bridges span the route, the one on the Longport-Somers Point Boulevard and that on the Absecon Boulevard having been added the past year.

A communication was received from the Borough of Laval-lette requesting dredging of the lateral channel from the Inland Waterway to the Public Dock at Lavallette. After considering the matter fully, the Board decided that under the law it had no authority to construct lateral channels from the Inland Waterway, nor would it favor legislation empowering them to build such laterals, unless the municipalities benefited would bear half of the cost of the same.

Information furnished Inspector Maupay shows there has been a considerable increase in commercial traffic near Atlantic City during the past year. These figures show a total of more than 100,000 tons of structural steel, coal, lumber, piling, gravel, cement, etc., transported, valued at over \$750,000. In addition there were about \$300,000 worth of oysters and clams carried, making a total of \$1,050,000. Shipments from Tuckerton and West Creek amounted to \$400,000, about the same as last year. From the several points along the waterway in Cape May County there was some increase over last year, the total amounting to \$608,000.

The City of Atlantic City has awarded the contract for a yacht landing in Garnder's Basin. This will consist of 8 piers 80' long with dock space 80' x 35' between, and will be dredged to a depth of nine feet at low water.

MAINTENANCE OF INLAND WATERWAY.

The contract for redredging the shoaled section in Swain's Channel and Pratt's Hole, Cape May County, was finished on May 2d, 1916; 43,275 cubic yards were removed at a unit price of eleven and one-half cents (\$0.11½), amounting to \$4,976.63.

The closing of Turtle Gut Inlet during the past year stops the cross-current and the consequent shoaling in Swain's Channel and Richardson's Channel, so that no further expenditure for maintenance in this vicinity need be anticipated for some time to come.

Owing to the Cape May Dredging Company's legal difficulties

no work has yet been done toward restoring the channel between Weak Fish Creek and Middle Thorofare. A resurvey of this territory in September last shows a better depth of water near Middle Thorofare, but also that the shoaling now extends further north into the cut, and the total quantity necessary to be removed in order to restore the channel to its full width and depth is 30,405 cubic yards, an increase of 4,223 cubic yards since the survey in 1915.

On the application of Cape May County to bulkhead and fill across Weak Fish Creek and Middle Thorofare, the United States Engineer gave a hearing at Ocean City on March 20th. Strong opposition on the part of local residents developed thereby, causing the government to refuse to permit the closing. This is to be regretted from the standpoint of maintaining the cut connecting these two thorofares, for such closing would have eliminated the cross-current from Corson's Inlet, causing the shoaling.

The Board having learned of shoaling of the dredged channel in Dung Thorofare, near Great Channel, and in Great Channel, near Gull Island, in the early spring, surveys were made to determine the extent of the filling at these points. At the former place it was found the original route would require the removal of 6,821 cubic yards to restore the channel, but by swinging one reach a little south at the entrance to Great Channel, ample width and depth could be obtained. Accordingly, this was done and the dredging avoided. At the other point the survey showed 5,575 cubic yards to be dredged over a distance of 866 feet. This was advertised and proposals received June 6th. The Rickards Dredging Company bid \$0.48 per cubic yard and the Hill Dredging Company \$0.44. These prices were considered too high, and it was decided to reject the bids and combine this job with other dredging in the vicinity.

Recent examinations by Inspector Maupay show other small shoaled areas in the vicinity of Ben Hand, Thorofare Bridge, across Ludlam's Bay, and four short sections in Grassey and Little Bays, all of which should be dredged without delay.

By resolution of the Board a survey has been made of Absecon Inlet with a view to closing the upper channel for the protection of the route of the Inland Waterway at this point. This survey is now in the hands of the United States Engineer's office at Wilmington for decision as to whether or not the Federal Government will permit this closing.

BAY HEAD-MANASQUAN CANAL.

Dredging of the first section of this canal was started late in December, 1915, under the contract awarded to the Rickards Dredging Company. Owing to the large number of roots and stumps encountered the work progressed slowly and was not completed until July 7th, 1915. 125,055 cubic yards were removed at a unit price of fifteen and eight-tenths cents (\$0.15⁸/₁₀), amounting to \$19,758.59. The distance covered amounted to 4,683 lineal feet.

See Appendix "A" for detailed report of Inspector of Inland Waterways.

EXAMINATION OF STATE BOUNDARY LINE MONUMENTS.

Under the Act of April 4th, 1891, the former Riparian Commission was required every three years to make an examination of the monuments marking the boundary line between the States of New Jersey and New York. During the year 1912 a very careful examination was made of the boundary line of the State under the direction of Mr. Charles Hopper, C.E., who had made the examination for several previous years, and a careful report of the examination was made to the Commission. All the monuments needing repairs or attention were put in good order in 1913.

The examination made during the year 1916 by Mr. Charles Hopper, C.E., under the direction of this Board, disclosed the fact that very little attention or repairs were needed, and such repairs were made at the same time the examination of the monuments was made, and a report made to the Board.

It is recommended that this report of the location and condition of the monuments marking the boundary line between the States of New Jersey and New York be printed, as it now shows the present owners of the properties and such data as will enable subsequent investigators to find the monuments without trouble, and a dissemination of the knowledge of the location of these monuments and their uses and purposes, and will tend to preserve them and prevent their disturbance by persons not knowing their importance and value. *

STATEMENT AS TO WHAT HAS BEEN DONE ON THE NEW JERSEY SHIP CANAL PROJECT.

On January 6th, 1916, the Board, considering the time opportune for the advancement of the ship canal project, addressed letters to Hon. Lindley M. Garrison, the Secretary of War, and

the Governor and Legislature of the State of New Jersey. The letter to the Secretary of War represented that the State, through the former New Jersey Ship Canal Commission and the Board of Commerce and Navigation, had run out on the ground and monumented the center line of the proposed canal, as adopted by the United States Government, between Morgan on Raritan Bay and Bordentown on the Delaware River. The acceptance by the Government of the line as monumented was asked, in order that the State might proceed to acquire the necessary right of way in accordance with the resolution of April 24th, 1911, adopted by the Legislature. An answer was received stating that the matter rested with Congress and advising that it be taken up with the New Jersey representatives.

The Board, on motion of Commissioner Runyon, passed a resolution in favor of a sea-level canal not less than 25 feet deep at mean low water, with a bottom width of 125 feet.

Hon. Thomas J. Scully, Congressman from New Jersey, was requested to have an item put in the Rivers and Harbors Bill for the re-examination necessary in view of this resolution.

A conference was held between the Secretary of War and the President of this Board, Commissioner Ward and the Chief Engineer. A sample of the maps showing the monuments in place was submitted to the War Department, and the Board was advised that these would probably be sufficient for the acceptance of the monuments.

The letter to the Government and Legislature announced the monumenting of the line and the request to the United States Government, and asked the consideration of an appropriation to secure the necessary right of way.

These letters were quoted in full in a speech by the Hon. J. Hampton Moore, of Pennsylvania, before the House of Representatives on January 25th, 1916.

A letter was received by the President of the Board from the Secretary of the Navy expressing interest in the project from the standpoint of national defense and of commerce.

On February 15th a bill was introduced in the New Jersey Legislature, by Senator Florance, providing for a referendum vote by the people of the State on the question of issuing bonds for the purchase of a right of way. Owing to some question as to the constitutionality of the bill as introduced, it was not enacted into a law.

Another bill has been prepared and will shortly be introduced in the Legislature.

The President of the Board wrote to Hon. Newton D. Baker, Secretary of War, informing him that the bill was introduced but not pressed for passage, and enclosing copies of the letters to the former Secretary of War, and to the Governor and Legislature of New Jersey. An acknowledgment and later a further answer was received, stating that the acceptance of the monuments could not be made until their location on the ground was checked. No money being available for that purpose it was necessary for the State to supply the funds. On account of some legal difficulties this was impossible at the time.

The Board has endeavored to place before the people of the State information of the value of the ship canal project, in order that the referendum may declare in favor of the acquisition of the right of way. A map has been made of the Inland Waterways from Chesapeake Bay to Massachusetts Bay, showing their relation to the Great Lakes and the anthracite coal fields. A special article illustrated by maps has appeared in the public press.

The Board was represented at the Convention of the Atlantic Deeper Waterways Association by Commissioner W. Parker Runyon, who addressed that body on the subject, and a statement with maps has been distributed there and elsewhere. The support of the Association was asked in a resolution passed by the Board at its August meeting.

DEPARTMENT OF POWER VESSELS.

The administration of the Department of Power Vessels has scarcely been reduced to the efficiency that the Board demands.

In order to put this Department on an economically operating basis it will be necessary, in the judgment of the Board, to enact additional legislation, and bills for this purpose will be submitted to the Legislature, and their enactment is urged.

See Appendix "B" for detailed report of Inspector of Power Vessels.

STATEMENT AS TO THE STATUS OF THE SO-CALLED LIGHTERAGE CASE.

Following the appointment of the Committee on Ways and Means to Prosecute the Case of Alleged Railroad Rate and Service Discrimination at the Port of New York, the Committee held many meetings, and through its endeavors subscriptions were obtained from the municipalities of Newark, Jersey City, Ridge-

wood, Elizabeth and New Brunswick, the total amount representing \$11,966.36 to December 31st, 1916.

The Committee appointed as counsel to prepare the complaint Messrs. George L. Record and Frank H. Sommer, and experts were retained to develop the case and to prepare exhibits and to get together testimony in support of the formal complaint.

The complaint was formally filed with the Interstate Commerce Commission on May 27th, 1916, and the hearing on the complaint was scheduled to commence in New York on November 13th, 1916. Upon agreement of counsel for both sides an adjournment of the hearing was had, and the date for commencing to take testimony was fixed for January 9th, 1917, at New York City.

The complaint itself was filed against the various railroad companies whose tariffs and operations covered the alleged discriminations, and since the filing of the complaint many interventions have occurred. The principal of these interventions are as follows:

Swift & Co., Freight Traffic Committee, Chicago Association of Commerce, Albany Chamber of Commerce, Commercial Exchange of Philadelphia, Erie Basin Board of Trade, Baltimore Chamber of Commerce, Board of Trade of Baltimore, New Jersey State Chamber of Commerce, Merchants and Manufacturers' Association of Baltimore, Philadelphia Chamber of Commerce, Public Service Commission for the First District, New York; Retail Dry Goods Association, New York City; State of New York, Advisory Council of Real Estate Interests, New York City; Chamber of Commerce of the State of New York, Merchants' Association of New York, Manufacturers' and Business Men's Association, New York; New York Produce Exchange, Central Mercantile Association, Brooklyn Coal Exchange, Staten Island Civic League, Standard Oil Company of New Jersey, Real Estate Association of State of New York, the City of New York, Taxpayers' Alliance of the Borough of the Bronx, Chamber of Commerce of Borough of Queens, Real Estate Board of New York, the Bronx Board of Trade, Maritime Association of the Port of New York, Brookhaven Improvement Association, Brookhaven, L. I.

The New Jersey State Chamber of Commerce appreciating the importance to the State of favorable action by the Interstate Commerce Commission has retained former Attorney-General Robert H. McCarter to appear in the matter on behalf of the complainants.

It is highly interesting to note that certain civic organizations of Staten Island, or the Borough of Richmond of Greater New York, have intervened on the side of the New Jersey interests, thus indicating that New York City is itself divided on this question.

LINKING UP THE SOUTH JERSEY FARMING DISTRICTS WITH THE MARKETS IN NEW YORK CITY.

The Board, in view of the expense attending the transportation of farm produce from southern New Jersey into the New York markets, and considering that the State has spent large sums of money on the improvement of the Inland Waterways, and that there was a steamboat line operating between New York City and Atlantic City daily, felt that it might be possible to link up the southern New Jersey farm lands with the New York markets by water transportation, thus reducing the cost of transportation, which is necessarily higher by rail than by water, and would pass this commerce around the congested railroad yards in the New Jersey portion of New York harbor.

It is well known that the steamboat line referred to above carried practically no cargo from Atlantic City to New York, but that most of the cargo was carried from New York to Atlantic City, the boats running light in the northerly direction. The average time of making this trip from Atlantic City to New York was ten hours.

In order to obtain the co-operation of the interests in New York, a meeting was held at the office of Borough President Marks of Manhattan, at which meeting President Smith appeared and spoke concerning this project. Various interests were presented at the meeting, including the New Jersey State Board of Agriculture, the New York Meat Market Commission, the railroads, the commission merchants, such associations as the Housewives' League, and others.

It was brought out at that meeting that it might be easily possible to establish terminal markets in Manhattan, possibly on property under some of the bridges to which the boats might come and at which the public sale of fresh produce from southern New Jersey could be quickly and cheaply made.

President Marks invited the New Jersey interests to appoint a committee to consider this matter, and he stated that he would appoint a committee, and that these committees would work together to determine how this very important problem could be worked out.

It is believed that with such a solution of the problem of bringing fresh vegetables and fruit into New York steps could be made toward decreasing the high cost of living.

STATEMENT REGARDING THE APPLICATION OF THE BOROUGH OF
LONGPORT FOR PERMIT TO CONSTRUCT A CONCRETE SEA WALL.

The New Jersey Harbor Commission, in 1915, at the request of the Mayors of the Boroughs of Longport and Stone Harbor, asking the New Jersey Harbor Commission, which was later merged into this Board, to make a study of the conditions along the ocean front of these boroughs, and to prepare a report for them with certain recommendations as to what should be done in order to prevent the further erosion of the beaches and to build up the beaches where they have been eroded, a careful study was made and a report was prepared by the Chief Engineer of the Board with definite plans of a form of bulkhead construction and a system of groynes in connection with this bulkhead. This combination of bulkhead and groynes was designed to resist the further encroachment of the sea and to build up a beach.

Nothing has been done by these municipalities in the way of carrying out the recommendations made by the Board.

In October, 1916, the Mayor of Longport called on the Chief Engineer of the Board and later appeared before the Board and formally asked that the Board direct its Chief Engineer to look over and to report on the adequacy of plans which had been prepared for the Borough of Longport by an engineering corporation.

The Mayor stated that there were certain objections that had been raised to these plans, and he felt that the approval of the plans by the Board would go a long way toward getting the unanimous approval of the property interests.

A hearing was thereupon held in the City Hall at Longport on October 25th, 1916, attended by President Smith, Vice-President Jenkinson, Commissioners White and Kirk, the Chief Engineer and Assistant Engineer Sherman, and the matter was fully discussed. Representatives of the engineering corporation were there and representatives of the property interests.

Following this hearing, on November 9th, 1916, the Chief Engineer prepared a report analysing these plans, and pointed out what, in his judgment, were important defects in them.

The Board thereupon issued a permit to the Borough of Longport to proceed with this work, and attached to this permit a copy of the report of the Chief Engineer.

The Board felt that its duty in this matter ended when it had analysed the application and the plans, and it fully informed the Borough as to its opinion regarding such plans, and that if the Borough decided to proceed with the work under these plans the Board would not withhold its approval for so doing.

STATEMENT AS TO THE NEWARK BAY BRIDGE OF THE CENTRAL RAILROAD COMPANY OF NEW JERSEY.

On March 1st the Central Railroad Company of New Jersey submitted plans of a proposed bridge across Newark Bay to take the place of the existing structure. The plans called for 39 deck girder spans of 125 feet each, supported on piers which leave clear openings of 110 feet at the water surface with a clearance of about 16 feet above mean high water.

On the site of the present lift span two new lift spans were to have clear openings of 100 feet each and a clearance of 25 feet above mean high water.

This total length of the proposed bridge was over 2,800 feet less than that of the present structure, the difference being made up in an embankment at the east end to extend to the present Pierhead Line, and of the west end to extend 1,500 feet outside the present New Jersey State Pierhead Line, and over 300 feet outside the location of the United States Pierhead Line adopted afterwards on November 13th, 1916.

The Committee on Harbor Development of this Board had a conference with the Engineers of the Central Railroad Company of New Jersey and reported that the plans in general were an improvement over the existing structure, but that there was grave questions of the propriety of the long fill beyond the Pierhead Line on the Elizabeth side.

The Board at the meeting of April 17th decided to take no action on the matter.

CODIFICATION OF LAWS.

One of the requirements of the act under which the Board is organized was that a codification of the existing laws relating to riparian rights should be made and printed, and the services of Mr. John H. Hartpence were secured, and the codification is now complete and in the hands of the printer. Copies will be available within a short time to persons desiring information on the subject.

FORECLOSURE OF LAPSED LEASES.

Under the provisions of Chapter 83 of the Laws of 1906, it is the duty of the State Treasurer to report to this Board on the first of January of each year such riparian leases executed by the State as are in arrears for rentals for over one year, and it becomes the duty of this Board to endeavor to collect the rentals due, failing in which it is its duty to proceed to foreclose the lease and recover the land into the State's control.

Under this law the following leases reported by the State Treasurer as in arrears were foreclosed on November 28th, 1916, and the lands became again the property of the State:

Lease to Mary M. Ward, dated November 27th, 1896.

Lease to Charles Carr, dated April 21st, 1910.

Lease to R. C. Bacot, assigned to Emily M. Pallen, dated August 7th, 1880.

The important result obtained by this law is to secure the prompt payment of the rentals due on riparian leases, failing in which the lands are recovered to the State, whereas before the enactment of the law great arrearages of rentals occurred, and there was no provision by which the lease could be terminated.

NEED FOR SPECIAL COUNSEL.

The activities of the Board have greatly increased, not only as to the extent, but as to the character of the questions involved, and at every meeting of the Board questions have arisen needing legal opinion and advice. The systematic examination and investigation into the occupation of the waterfront of the State has developed so great a number of cases and of such diversified character that this branch of the activity of the Board alone has called for unusual consideration by the legal department.

The interpretation of legislative grants, the questions of occupation, among which are some running back a great number of years and of immense importance to the State, all seem to call for an undue and unusual and unprovided for amount of time and attention on the part of the existing organization of the Attorney-General's office, and while the Board acknowledges the careful and helpful assistance of the Attorney-General's office in the determination of such cases as have been presented to it, it feels that it would be in the interests of economy and of efficiency if special counsel could be assigned to the Board to sit with it and advise in its considerations, and take special charge of

cases that require a greater amount of time and attention than the Board feels it would be warranted in asking the Attorney-General's office to devote to them.

CONVENTION OF THE AMERICAN ASSOCIATION OF PORT AUTHORITIES.

The Board took an active interest in the Convention of the American Association of Port Authorities, in which the Board has membership, at Montreal, on September 13th, 14th and 15th, 1916, and President Smith was designated to attend the convention.

The proceedings were participated in by high officials of the Canadian Government, by the city of Montreal, and the Board of Harbor Commissioners of Montreal, and by leading port officials of the Atlantic, Gulf and Pacific coasts.

The importance of this Association is increasing and it has official recognition by the Secretary of Commerce, who, through the Department of Commerce, is co-operating to obtain information necessary to the study of the port problems of the United States, and in the compilation of statistics, and one of the most important questions before the Association is that of the segregation of terminal charges by the railroads.

President J. Spencer Smith was elected the Fifth Vice-President of the Association, and the Chief Engineer of the Board was re-elected a Director of the Association.

The next convention of the Association will be held in Cleveland on September 11th, 12th and 13th, 1917, and the Board will urge that the 1918 convention of the Association be held within the State of New Jersey. This will be important to the State as it will bring to the attention of the port authorities the importance of the State as a medium to the passage of commerce and will focus the attention of the Association upon what is being done within the State and upon the possibilities for further developing the State, and no doubt important suggestions will result from the holding of such a convention.

The Board therefore urges that the Legislature appropriate a suitable sum of money for the purposes of this convention.

EXTENSION OF NAVIGATION IN THE DELAWARE RIVER BETWEEN TRENTON AND PHILLIPSBURG AND EASTON.

The Board has given very careful consideration to the question of the extension of navigation in the Delaware River from Trenton to Phillipsburg and Easton.

The District Engineer having charge of this matter, in accordance with the provisions of the Rivers and Harbors Bill, at the direction of the Secretary of War, had prepared a report on this project with a recommendation that the project was not worthy of a detailed survey.

Thereupon the President of the Easton Board of Trade invited the President of the Phillipsburg Board of Trade and other prominent citizens of Easton and Phillipsburg, together with State and Federal officials, to attend a meeting to be held in Easton under the direction of the New Jersey State Board of Commerce and Navigation to consider this question. There were present at this hearing, representing the Board, the following: President Smith, Vice-President Jenkinson, Commissioner Kirk and the Chief Engineer, who spoke upon this project, upon its importance to the transportation interests of the country, upon its importance in the matter of extending navigation nearer to the great coal and slate fields, and of its importance to the States of New Jersey and Pennsylvania.

At the earnest request of the Board of Commerce and Navigation the Chief of Engineers of the United States Army directed that the adverse report of the District Engineer be returned to the District Engineer for further consideration, and the interests of Phillipsburg and Easton, working with the Board of Commerce and Navigation, are preparing maps, exhibits and a report for presentation to the District Engineer in order that he may have further information as to the value of this project, and in order that a survey may be recommended and authorized.

The Board was represented at a hearing in Camden on the question of dredging by the Federal Government of the channel between Petty's Island and the New Jersey shore.

STATEMENT AS TO THE APPLICATION OF EAST ORANGE, MONTCLAIR
AND GLEN RIDGE FOR PERMIT TO CONSTRUCT A SEWER
OUTFALL IN NEWARK BAY.

Col. C. H. McKinstry, United States Engineer Officer in charge of the Third District, New York, informed the Board, under date of June 20th, 1916, that he had received an application "from the City Clerk of East Orange, N. J., which is in effect an application on the part of the cities of East Orange, Montclair and Glen Ridge, N. J., to dispose of the sewage of those towns in the upper end of Newark Bay through an outfall to be located about half a mile above the Lehigh Valley Railroad bridge," and requested this Board to consider the matter.

The Board held a hearing on this matter on November 10th, 1916. The interests of the city of Newark were represented, as were those of the Passaic Valley Sewerage Commissioners, and both expressed strong opposition to the Board granting the request of the applicants, the basis of the objections appearing to be that they should combine with Newark and other cities which are now contributing toward the construction of the Passaic Valley Sewer, and that these cities should discharge directly into this sewer.

The Board decided to take no action in this matter pending a more formal application from the municipalities concerned.

STATEMENT CONCERNING THE APPLICATION OF THE COMMISSIONERS OF THE PALISADES INTERSTATE PARK.

The application of the Commissioners of the Palisades Interstate Park for lands under water on the Hudson River fronting on the park has been receiving the most careful consideration by the Board, but up to the present time the Board has not yet reached a conclusion as to a policy with respect to this application.

NEW POLICY WHICH THE BOARD HAS UNDER CONSIDERATION.

The Board has under consideration the adoption of a policy whereby conveyances, leases or permits may be made to municipalities at a lower figure than to private individuals or corporations, where such municipalities have a definite plan for the improvement of such property, such plan meeting with the approval of the Board; and where the title of the lands and the improvement so made shall remain in the municipality, and where the interest of the public in the use of such facilities shall, in the judgment of the Board, be properly safeguarded. Such a conveyance, lease or permit to provide that in case the municipality shall fail in its part of the contract, that the lands so conveyed, leased or permitted shall revert with all improvements to the State without cost to the State. This policy the Board believes will encourage the development of publicly owned terminals, which will aid in the upbuilding of commerce and industries throughout the State.

APPENDIX "A."

Annual Report of the Division of the Inland Waterways.

It is the intention of the Inspector to give a concise and comprehensive report of the Inland Waterway Division of the Board of Commerce and Navigation for the year ending October 31st, 1916.

The channels of the Inland Waterway are past the stage of being a luxury for the pleasure of yacht owners and pleasure craft. The Inland Waterway is a necessity, and continues to be in greater demand for commercial traffic, thousands of tons of structural iron, crushed stone, sand, cement, lumber and timber of all kinds, coal, gravel, farm and sea products, etc.; at one point 1,144 boats, and another point 978 passed through two drawbridges within one month; 75% of these boats were commercial. Records obtained from towns bordering on the Inland Waterways show great increase in commerce, which gives employment to a greater number of men. Passenger traffic has increased at some points, while at other points it has decreased.

The channels of the Waterway have maintained a good depth, except at points which will be described hereafter. No money has been expended for maintenance dredging of channels from the date the Department of Inland Waterways was created, except a small amount at Swain's Channel (see Annual Report for 1915, page 45); the money was well invested.

The strong current passing through Turtle Gut Inlet caused live sand to be carried into Swain's Channel, Jarvis Sound and Richardson's Channel, which formed sand bars and lumps, causing great inconvenience and loss to freight and passenger boats.

The inlet has been closed by private interests at a cost of approximately \$25,000. The closing of this inlet has been a great benefit to the three above-named thorofares, which will no doubt save the State the expense of dredging in the future. The last soundings taken at a recent date, and at the slack of flood tide, showed 12 feet and no bottom, except on two lumps, one in Swain's Channel, the other at Pratt Hole, showing 11' 6"; the tide rises and falls about 4' 6" in these channels; the current on the ebb tide is very swift, caused by the water being diverted from its original course, and confining it in one channel, which runs through Richardson's and Swain's Channels, and Jarvis

Sound, which will keep these channels well scoured; originally this water flowed through Turtle Gut Inlet.

The Weakfish-Middle Thorofare meadow cut, near Corson's Inlet, continues to give trouble (see Annual Report 1915, page 45). No doubt if these two thorofares had been closed, as recommended, the same conditions would prevail as at Turtle Gut Inlet and Swain's Channel. On March 25th a hearing was held at Ocean City before one of the United States Army Engineers regarding the closing of these two thorofares, and there was much opposition to the closing of them. On January 15th, 1916, a report was submitted regarding this cut, soundings were taken on August 25th, 1916, a survey was made on September 12th, and at a later date soundings were again taken.

The channel off Rum Point, crossing Absecon Inlet, continues to change; it is difficult to keep the deep water marked and buoyed on account of the shifting sands, the channel requires continual inspection, and changing the buoys, and at this point there was a better channel this year than last year. At low water a boat drawing 3 feet could not pass. This season the average depth at low water was from 4' to 4' 6" for a distance of about 200 feet; after crossing this shallow place the water is very deep. It is necessary that this part of the waterway should be improved and taken care of at all times, even if a dredge is working at all times, as tons of freight of all kinds pass over this stretch of the Inland Waterway from Atlantic City to Great Bay. The traffic has increased to a very great extent, as data will show under commerce and passenger traffic.

This Inland Waterway was constructed to accommodate and induce boats of all kinds to navigate between all towns on the Jersey coast, and commerce has increased to so great an extent on this particular part of the Waterway that it is necessary to maintain a depth of water in the channels of not less than 6' at low water. At that depth of water tugboats could not navigate at low water (about 8' would be better). The above does not include hundreds of yachts ranging in size and value from the humble garvey, costing about \$75.00, to the palatial yacht, measuring over 110 feet and valued at \$100,000.

CHANNEL MARKINGS.

In addition to the 38 spar buoys placed by the United States Lighthouse Department, which are removed and new spars put in their place, this division of the Department, under the personal supervision of the Inspector, with the assistance of the field en-

gineer, placed 12 spar buoys to mark the channels in the north end of Barnegat Bay; 11 spars from Waretown to Harvey Cedars; 11 spars from Cedar Bonnett to Mud Cove; 1 spar at Beach Cove, and 14 between miles 54 and 62.

To complete the markings it will require about 55 more spar buoys of different sizes. It will be necessary to replace the spar-buoy markings at least every two years (would be better to replace spar buoys every year), as it is necessary to remove marine growth, and to allow the spars to dry or reseason, which would kill all worms; therefore, it would require an extra set of spars with iron straps, but no anchors or shackles, as the two latter-named parts would last indefinitely. These spar buoys are of different sizes, as follows: 6" x 12', 7" x 14', 8" x 20', anchored with concrete anchors weighing 300, 400 and 1,000 pounds each. The object is to place markings of this kind in open waters, eliminating the beacons and stakes to a great extent, which the ice destroys; the spar buoys being permanent, would aid navigation during the winter and early spring months. There was placed 7 meadow ranges, and 3 were repaired; these ranges can be seen for a long distance.

From the date of the act, March 17th, 1908, creating the Department of Inland Waterways (Chapter 83 of the Laws of 1908), there has been but \$5,000 expended for maintenance dredging. The time has arrived when particular attention should be given to the maintaining the depth of the channels, especially when tugboats drawing 7 feet and towing barges carrying 200 tons of freight navigate these waters. Chapter 27 of the Laws of 1912 recommends the appropriation of a sum not exceeding \$25,000 for maintaining the Waterway, and to repeat my recommendation in the Annual Report for 1915. The Waterway is a road for boats requiring continual repairs, and should have a liberal allowance for the purpose.

The necessary funds being available, all material was prepared during the winter months in anticipation of an early start to mark all channels of the Waterways. About the same number of stakes, kegs and other markings were used except mid-channel barrel markings, which are being done away with. (For description of markings and rules for navigating the Inland Waterway, see Annual Report for 1915, page 47.) After considerable difficulty, experienced watermen were employed and a field team was assembled, consisting of Field Engineer, cook, four men and the Inspector, who remained with the team until the work was completed.

On April 27th part of the field (boat) equipment left for Bay Head, where the house and other boats were picked up. Until May 22d stormy weather was experienced, heavy winds, fogs, rain, etc., after which good weather prevailed. The marking of the channels was completed on June 8th, requiring 42 days by deducting time lost in running from Atlantic City to Bay Head, days no work could be done on account of bad weather, Sunday and Saturday half-holidays, the team lost 12 days; actual working time, 30 days. After returning to Atlantic City, part of the field team was laid off, with 3 men and the Inspector, the fleet was towed to Bay Head, arriving June 14th. This year the team made a record in marking the channels.

This is an opportune time to voice the expressions of the yachtmen and others who complimented the Department on the efficient way the channels were marked.

The survey across Absecon Inlet, as recommended by the Board, was finished September 15th, after which the survey was plotted and blue prints were forwarded to be acted on by engineers and experts with an idea of constructing a permanent channel which would not be filled with the shifting sands.

BRIDGES.

The Inspector respectfully refers to his recommendations in the Annual Reports for 1914 and 1915, and is pleased to note several have been followed. All bridges over the waterway erected recently have 9' vertical and 50' clearance in the draw; 16 bridges are operated with power, either gasoline or electric, and 9 by hand. All bridges having a draw should be opened within 3 minutes; the hand-operated draws require from 5 to 20 minutes to open, causing considerable trouble, the channels being narrow, it is difficult to handle large boats, which makes it dangerous. One bridge on the waterway, which is antiquated, having a 25' 5" clearance, has caused more trouble than any draw on the route; large boats cannot use the waterway on account of this bridge. On one occasion a dredge with equipment going south was compelled to return from Sea Isle City to Great Egg Harbor Inlet, where the crew took her to sea and towed south to Hereford Inlet, and north on the waterway to place of operation.

Atlantic City had awarded a contract to build one of the finest and safest harbors for yachts on the coast, if not in the country. Docks will be 800' long, 35' wide, with a depth of 9'

at low water. Atlantic City will also construct a land-locked harbor for large sea-going craft of all kinds; at this point railroad terminals and storage houses will connect with both freight and passenger vessels.

It has been agitated by large firms to have crude oil and coal shipped to this town by water, barges drawing from 12' to 14' will be used, but this idea will not be carried out, unless two or three shallow places (about 500' in all) in the channel of the waterway is deepened.

BAY HEAD-MANASQUAN CANAL EXTENSION OF THE WATERWAY.

Regarding the property on the right of way of the canal, title has been transferred to the State for 20 parcels of land. It will be necessary to condemn at least 7 parcels on account of not finding the heirs, unreasonable price asked for by the owners, and co-heirs refusing to execute the deed. Nineteen parcels are in course of settlement, and would have been settled had the owners given assistance. The principal causes for not settling are as follows: unrecorded deeds, unpaid taxes, uncanceled mortgages and judgments, etc. The first section of the canal, 3,500 feet, was commenced September 12th, 1908, and completed September 26th, 1916. Fifty thousand dollars is now available for the construction of the second section of the canal. (See Engineer's Report.)

INSPECTIONS.

During the year the Inspector made a number of inspections, both by water and land, to note the actual conditions of the channels at all times. A complete record of these conditions was obtained; buoys, beacons and markings were replaced and changed when necessary; surveys and soundings were put on record, and a detailed account of same is on file. During these inspections, seventy-seven properties were found to be on State riparian grounds, on the banks of the Cohansey and Maurice Rivers and other creeks and rivers leading into the Delaware Bay, and coves from Cape May to and including the Cohansey River; location, measurement and tracings of these properties have been forwarded to the riparian branch of this Board. Some of these properties are very valuable to the State, owners of the upland not having obtained either a grant or lease.

RECOMMENDATIONS.

To compel installation of power to operate the draw on all bridges now in use, operated by hand. Before granting a permit to repair or construct a bridge or draw, insert a clause that the draw in bridges have 12 feet clearance above normal high water, and be operated by engine, electric or other power, except hand power; also that the owner or owners be compelled to maintain the required depth of water in the channels of the waterway for a distance of not less than 500 feet, or more, if necessary, for the approach of either side of the bridge, and also to have fenders erected on either side of the draw for a distance of not less than 50 feet to protect boat traffic.

The construction of auxiliary channels—see Reports of 1914 and 1915.

State ownership of a harbor and storehouses for the use of the several departments operating boats—see Annual Report for 1915.

Atlantic City.—The following data was obtained from consignors and consignees who ship and receive goods over the Inland Waterway—machinery, coal, stone, cement, sand, gravel, lumber oiling, brush, farm produce, sea products, etc.:

Structural steel,	750 tons, valued at	\$105,000
Machinery,	1,000 " " "	200,000
Crushed stone,	2,800 " " "	3,500
Sand,	4,600 " " "	9,200
Cement,	812 " " "	7,308
Gravel,	40,000 " " "	13,300
Lumber (creosoted),	3,250 " " "	65,000
Piling,	15,000 " " "	31,500
Miscellaneous,	16,750 " " "	8,375
Coal,	1,000 " " "	5,000
Garbage,	13,200 " "	
99,162 tons.		\$748,183

Note.—The above values given are approximate, the prices fluctuate from day to day. The number of tons of garbage carried (13,000) was from June 1st to October 31st, 1916.

25,560 barrels of fish, valued at	\$230,040
34,800 bushels of oysters, valued at	38,280
3,000,000 clams, valued at	22,500
12,500 bushels of seed oysters, valued at	4,375
\$295,195	

Note.—Fish was not as plentiful at this point, but prices ranged higher; there was an increase in shipment of bay products.

Passengers carried to and from Beach Haven, and Tuckerton to Atlantic City,	5,500
Passengers carried from Longport to Ocean City and return,	48,935
	<hr/> 54,485

Note.—The above shows a decrease in the number of passengers carried.

Building material, valued at	\$62,000
Country produce, valued at	83,000
Miscellaneous material, valued at	17,000
	<hr/> \$162,000

Note.—There was a falling off of building material, but an increase of country produce, and also other material.

All the shipyards in Atlantic City have been busy during the last year, both in repair work and building new boats of all kinds; machine shops have all the work it is possible to attend to.

Tuckerton, N. J., shipped approximately the same quantity of sea and bay products as last year, which was valued at \$362,000. This year the Federal Government dredged the channel in the bay leading to Tuckerton Creek, and also placed range lights to guide mariners entering this creek.

West Creek, N. J., and Barnegat, N. J., also shipped the same quantity of sea and bay products; at these points large quantities of bay and country produce were shipped. Absecon also shipped \$40,000 worth of oysters and clams, which is a slight increase over last year.

There has been considerable increase in the quantity of fish shipped from Cape May County; fishing is the principal industry and brings in a large revenue.

The number of barrels of fish shipped from Ocean City, Somers Point and other smaller places are as follows:

3,750 barrels, valued at	\$33,750
20,194 barrels, from Sea Isle City, valued at	181,746
36,766 barrels, from Anglesea and Holly Beach, valued at	330,984
6,872 barrels, from Cape May, valued at	61,848
	<hr/> \$608,328

Passengers carried on boats from Anglesea to Stone Harbor, 14,375; from Anglesea to Cape May, 714.

APPENDIX "B"

**Division of Motor Boat Inspection.—Report of Registrations
and Licenses Issued During the Year 1916.**

428	Private motor boats registered at \$1,	\$428.00
1	Vessel licensed under 2 tons, at \$3,	3.00
43	Vessels licensed under 10 tons, at \$10,	430.00
3	Vessels licensed over 10 tons, at \$15,	45.00
5	Original Engineers' Licenses, at \$5,	25.00
2	Renewal Engineers' Licenses, at \$3,	6.00
1	Original Master's License, at \$5,	5.00
3	Renewal Masters' Licenses, at \$3,	9.00
8	Original Masters' and Engineers' Licenses, at \$5,	40.00
37	Renewal Masters' and Engineers' Licenses, at \$3,	111.00
		<hr/> \$1,102.00

LIST OF BOATS REGISTERED AND LICENSED ON DIFFERENT LAKES IN NEW JERSEY.

<i>Lake.</i>	<i>Licensed Vessels.</i>	<i>Registered Boats.</i>
Budd Lake, .....	..	2
Culver Lake,	1	1
Deal Lake,	11	9
Green Pond,	1	8
Hopatcong Lake, ..	31	400
Lenape Lake,	1	...
Passaic River,	1	7
Union Lake,	1	1

APPENDIX "C."

Conveyances by Board of Commerce and Navigation from January 1st, 1916, to December 31st, 1916.

GRANTS.

<i>Date.</i>	<i>To Whom Made.</i>	<i>Locality.</i>	<i>County.</i>	<i>Amount.</i>
Aug. 3, 1915,	The Board of Chosen Freeholders of County of Monmouth,	.....	Monmouth,	\$112.00
Nov. 16, 1915,	Palisades Improvement Company,	.....	Bergen,	1,580.00
Jan. 3, 1916,	Ventnor City,	.....	Atlantic,	730.00
Jan. 3, 1916,	Palisades Improvement Company (confirmatory grant),	.....	Bergen,	Nominal
Jan. 3, 1916,	South Jersey Realty Company,	.....	Cape May,	50.00
Jan. 3, 1916,	Balback Smelting and Refining Company,	.....	Essex,	846.75
Jan. 18, 1916,	Mahlon W. Newton,	Atlantic Ocean,	Atlantic,	1,700.00
Jan. 18, 1916,	Agnes R. Raabe,	Manasquan River,	Ocean,	375.00
Feb. 15, 1916,	Board of Freeholders of County of Atlantic,	Abscon Creek, Jonathan Thorfare, Beach and Duck Thorfare and all other crossings,	Atlantic,	1,000.00
Feb. 15, 1916,	The Martin Dennis Company,	Hackensack River,	Hudson,	3,431.20
Feb. 15, 1916,	William P. Terhune,	Overpeck Creek,	Bergen,	406.40
Feb. 15, 1916, .....	.....	Overpeck Creek,	Bergen,	44.80
Mar. 21, 1916, .....	.....	Raccoon Creek,	Gloucester,	80.00
Mar. 21, 1916, .....	.....	Arthur Kill or Staten Island Sound,	Union,	10,000.00
Mar. 21, 1916, .....	.....	Hackensack River,	Hudson,	10,450.00
Mar. 21, 1916, .....	.....	Delaware River,	Salem,	2,000.00
Mar. 21, 1916,	Pennsgrave Pier Company,	.....	Ocean,	150.00
Mar. 21, 1916,	Mayor and Council of Borough of Point Pleasant Beach,	.....	Hudson,	30,089.20
Apr. 17, 1916,	Sea Board By-Product Coke Company,	.....	Essex,	93,660.00
Apr. 17, 1916,	The Mayor and Common Council of the City of Newark,	.....	Cumberland,	Nominal
Apr. 17, 1916,	William C. Mulford (confirmatory grant),	.....	Gloucester,	132.00
Apr. 17, 1916,	Gloucester Turnpike Company,	.....	Cape May and Bay,	50.00
May 15, 1916,	Atlantic City Electric Company,	.....	Atlantic,	Nominal
June 19, 1916,	The W. G. Bartlett Company (confirmatory grant),	Abscon Inlet,	Hudson,	1,625.00
June 19, 1916,	R. T. Babbitt,	Bellman's Creek,	Cumberland,	291.00
June 19, 1916,	Harry Stowman,	Maurice River,	Ocean,	100.00
June 19, 1916,	W. Mercer Baird and Felix H. McClellan, Exrs., etc.,	Liberty Thorfare,	Ocean,	2,275.79
June 19, 1916,	Normandy Beach Realty Company,	Barneget Bay,	Hudson,	40,479.90
June 19, 1916,	Park Commission,	Newark Bay,	.....	.....
July 17, 1916, .....	..... & Son Ship and Engine Building	Delaware River,	Camden,	3,000.00
July 17, 1916,	Wenonah Realty Company,	Barneget Bay,	Ocean,	604.78
July 17, 1916,	City of Atlantic City,	Inside Thorfare,	Atlantic,	250.00
July 17, 1916,	West Jersey and Seashore Railroad Company,	Grassy Sound,	Cape May,	100.00
July 17, 1916,	Arthur and Rose Thompson,	Overpeck Creek,	Bergen,	94.00
July 17, 1916,	Cumberland and Maurice River Railroad Company,	Maurice River,	Cumberland,	1,506.00
July 17, 1916,	West Jersey and Seashore Railroad Company,	Maurice River,	Cumberland,	684.00

GRANTS.

<i>Date.</i>	<i>To Whom Made.</i>	<i>Locality.</i>	<i>County.</i>	<i>Amount.</i>
Aug. 21, 1916.	John A. Rutherford, and Cora B., his wife,	McClees Creek,	Monmouth,	\$1,500.00
Aug. 21, 1916.	E. I. du Pont de Nemours and Company,	Delaware River,	Gloucester,	7,970.00
Aug. 21, 1916.	E. I. du Pont de Nemours and Company,	Delaware River,	Salmon,	26,430.00
Aug. 21, 1916.	Vacuum Oil Company,	Delaware River,	Gloucester,	60,477.00
Aug. 21, 1916.	road Company,	Hudson River,	Bergen,	10,000.00
Sept. 21, 1916.	ry,	Beach Thorofare,	Cape May,	500.00
Sept. 21, 1916.	Company,	Delaware River,	Camden,	1,500.00
Sept. 21, 1916.	Company,	Delaware River,	Camden,	3,000.00
Sept. 21, 1916.	Clay Pit Creek,	Monmouth,		415.00
Sept. 21, 1916.	Cooper River,	Camden,		1,427.84
Nov. 20, 1916.	William Gottlieb and Marie Gottlieb,	Delaware River,	Salmon,	1,000.00
Nov. 20, 1916.	(extension to new line)	Overpeck Creek,	Bergen,	470.48
Nov. 20, 1916.	The Mayor and Council of Beach Haven	Little Egg Harbor or Tuckerton Bay,	Ocean,	Nominal
Nov. 20, 1916.	(extension to new line)	Delaware River,	Gloucester,	Nominal
Nov. 20, 1916.	E. I. du Pont de Nemours and Company (extension to new line),	Delaware River,	Gloucester,	Nominal
		Total,		\$323,077.94

LEASES.

<i>Date.</i>	<i>To Whom Made.</i>	<i>Locality.</i>	<i>County.</i>	<i>Principal Sum.</i>
Jan. 3, 1916.	American Synthetic Dyes, Inc.,	Passaic River,	Essex,	\$117,700.00
June 19, 1916.	Jessie I. Courter, Caroline May Courter, Charlotte Grace Courter and Joseph E. Meyer (confirmatory lease),	Passaic River,	Essex,	4,929.00
		Total		\$16,629.00

LIMITED LEASES (FIFTEEN YEARS).

<i>Date.</i>	<i>To Whom Made.</i>	<i>Locality.</i>	<i>County.</i>	<i>Annual Rental.</i>	<i>Convertible Within Five Years at</i>
Feb. 15, 1916.	Maas & Waldstein Company,	Passaic River,	Essex,	\$1,508.74	\$21,553.50
Mar. 1, 1916.	The Holland Company,	Hackensack River,	Hudson,	280.00	4,000.00
April 17, 1916.	Company,	Passaic River,	Essex,	1,312.50	18,750.00
May 15, 1916.	Richard O. Rue,	Passaic River,	Essex,	1,452.20	20,745.25
May 15, 1916.	Harry S. Barber,	Raritan River,	Middlesex,	54.60	780.00
July 17, 1916.	Standard Shipbuilding Corporation,	Delaware River,	Salmon,	87.50	1,250.00
Nov. 17, 1916.	Theodore R. Hoffman, Trustee,	Newark Bay,	Union and Hudson,	3,213.00	45,000.00
Nov. 20, 1916.	Kill van Kull,	Hudson,	Hudson,	1,593.62	22,766.00
		Total,			\$135,745.25

CONVERSIONS.					
<i>Date.</i>	<i>To Whom Made.</i>	<i>Locality.</i>	<i>County.</i>	<i>Amount.</i>	
Jan. 18, 1916,	Electric Boat Company (conversion of lease to W. W. Dashiell of November 7, 1889),	Newark Bay,	Hudson,	\$526.60	
Feb. 15, 1916,	Newark Bay,	Essex,	42,190.00	
Feb. 15, 1916,	Passaic River,	Hudson,	1,143.22	
Feb. 15, 1916,	Atlantic Ocean,	Atlantic,	730.00	
June 19, 1916,	Hackensack River,	Hudson,	1,310.00	
June 19, 1916,	The Board of Commissioners of the City of Passaic (conversion of its lease of October 29, 1914),	Passaic River,	Passaic,	5,000.00	
Sept. 21, 1916,	The Holland Company (conversion of its lease of March 21, 1916),	Hackensack River,	Hudson,	4,000.00	
				Total,	\$54,899.82
LICENSES.					
<i>Date.</i>	<i>To Whom Made.</i>	<i>Locality.</i>	<i>County.</i>	<i>Amount.</i>	
May 25, 1916,	Gibb and Stephenson Bros., Inc. (revocable; expires August 1, 1916),	Main Channel in Corson's Inlet, Weak Fish Creek, Middle Thorofare,	Cape May,	\$50.00	
June 5, 1916,	New York Telephone Company (revocable),	Raritan Bay,	Monmouth,	25.00	
June 27, 1916,	Great Egg Harbor Bay,	Cape May and Gloucester,	25.00	
Aug. 30, 1916,	Delaware River,	Atlantic,	25.00	
Oct. 11, 1916,	Delaware River,	Gloucester,	25.00	
Oct. 11, 1916,	Delaware River,	Camden,	25.00	
Nov. 22, 1916,	Delaware River,	Camden,	25.00	
Nov. 23, 1916,	Delaware River,	Camden,	25.00	
Nov. 23, 1916,	Overpeck Creek,	Bergen,	5.00	
Nov. 23, 1916,	Newark Bay,	Hudson,	5.00	
Nov. 23, 1916,	Bergen,	5.00	
Dec. 4, 1916,	Hudson,	5.00	
Dec. 4, 1916,	Union,	5.00	
Dec. 4, 1916,	Hudson,	5.00	
Dec. 11, 1916,	Hudson,	5.00	
Dec. 13, 1916,	Delaware River,	Salem,	25.00	
Dec. 13, 1916,	Newark Bay,	Hudson,	5.00	
Dec. 13, 1916,	Hackensack River,	Hudson,	5.00	
				Total,	\$270.00

APPENDIX "D"

Form of Revocable License.

THE STATE OF NEW JERSEY:

To all to whom these presents shall come or may concern, GREETING:

WHEREAS, Pursuant to an act of the Legislature of said State, approved April 8th, 1915, entitled "An act creating a department to be known as the Board of Commerce and Navigation, and vesting therein all the powers and duties now devolved, by law, upon the Board of Riparian Commissioners, the Department of Inland Waterways, the Inspectors of Power Vessels, and the New Jersey Harbor Commission," and other acts and joint resolutions of the Legislature of said State,

has applied to the Board of Commerce and Navigation of said State for a license to use a certain

situate upon lands of the State under water, hereinafter described:

AND WHEREAS, It appears that the said

is

AND WHEREAS, The said Board of Commerce and Navigation, to wit: J. SPENCER SMITH, RICHARD C. JENKINSON, W. PARKER RUNYON, JOHN M. WARD, WILLIAM L. SAUNDERS, J. WARD RICHARDSON, WILLIAM T. KIRK, and ALLEN K. WHITE, having due regard to the interests of navigation and of said State, have agreed to grant said applicant a license revocable at the pleasure of the said Board of Commerce and Navigation, as hereinafter stated, to use a certain

situated upon lands under water hereinafter described, belonging to the said State of New Jersey, and have determined that the compensation or license fee shall be at the rate of five dollars (\$5) per year.

Now, therefore, The State of New Jersey, by the said Board of Commerce and Navigation, in consideration of the premises and of the license fee or compensation herein agreed to be paid, and the terms, covenants and conditions herein contained, does hereby authorize, allow and license the said

to use a certain

situated upon lands of the State described as follows:

All

Said license, authority and privilege is to continue from the day of the date hereof until January 1st, 1918, unless said license shall be prior thereto

revoked or declared forfeited as hereinafter provided by the said Board of Commerce and Navigation, or their successors in office.

And it is expressly agreed and provided that the said Board of Commerce and Navigation, or their successors, may withdraw, terminate or revoke the license hereby given and all the rights and privileges thereunder at any time prior to the expiration of the said term mentioned above, upon notice to the said

his heirs or assigns, by passing a resolution to that effect, and that upon the passage of such resolution by the said Board of Commerce and Navigation, or their successors, the said license and all rights and privileges thereunder shall thereupon cease and determine.

The said license is also subject to the payment of a compensation or license fee to the State of New Jersey at the rate of five dollars (\$5) per annum, the same to be paid in advance on the delivery of this license, and thereafter on the first day of January in each year.

And provided, further, that nothing in this instrument contained shall, in any manner, affect the rights of any shore owner as now existing under the laws of this State.

In witness whereof, the said Board of Commerce and Navigation has caused these presents to be signed by its Chief Engineer and Secretary, this
day of , nineteen hundred and

.....
Chief Engineer and Secretary,
Board of Commerce and Navigation
of the State of New Jersey.

Document No. 42

Fifth Annual Report

OF THE

DEPARTMENT OF WEIGHTS
AND MEASURES

For the Year 1916

STATE OF NEW JERSEY

Fifth Annual Report

of the

Department of Weights and Measures

For the Year Ending December 31

.1916

WILLIAM L. WALDRON

Superintendent

TRENTON, N. J.

MACCRELLISH & QUIGLEY Co., State Printers

1917

STATE OF NEW JERSEY.
DEPARTMENT OF WEIGHTS AND MEASURES.

TRENTON, N. J., January 31st, 1917.

Hon. Walter E. Edge, Governor of New Jersey:

SIR—In accordance with the provisions of Section 19, Article 4, Chapter 201 of the Laws of New Jersey for 1911, I have the honor of submitting to the Legislature, through you, the fifth annual report of the Department of Weights and Measures.

Respectfully yours,

WILLIAM L. WALDRON,

Superintendent.

INTRODUCTION.

Honest weights and measures are in use in greater numbers in New Jersey to-day than ever before. City and county officials, aided by assistants of this Department, have brought about this highly-desirable condition by five years of unremitting effort. It is fortunate that this condition obtains for the purchasing public because prices of all foodstuffs are so high.

In view of the fact that no unusual scheme for cheating was detected during 1916, it would appear that vigilance on the part of superintendents has reduced dishonesty and fraud to a minimum. This is borne, too, by the fact that there were fewer prosecutions and convictions last year than any year since the Department was organized.

Weight and measure laws are strictly complied with by merchants, who no longer look with suspicion upon inspections and inspectors. They now realize that competition has been placed on a fairer basis and that they share with the public in the benefits brought about by the higher standard of dealing.

Another important fact which has helped the cause of honest weights and measures is the attitude of the purchasing public. Housewives now take more of an interest in honest weights and measures than they used to; buying is done more methodically, purchases are "checked up," and there are other unmistakable evidences of progress.

All this, of course, is very gratifying, but it should not be inferred that everything in the line of weight and measure inspections has been completed. Such a conclusion would be wrong. A number of important projects remain to be acted upon, which unfavorable conditions and circumstances prevented action being taken up sooner. But it would seem that the time is ripe for weight and measure officials to take up the testing of gas, electric and water meters. Other lines of inspection have been highly developed, and the experience gained in other endeavors would stand officials in good stead in handling meters. It cannot be denied that more extensive testing arrangements than now obtained would be desirable. Nor can it be doubted that weight and measure officials would distinguish themselves creditably if entrusted with the inspection and testing of gas, electric and water meters. Besides meter testing, there are other things to claim attention.

There will be no difficulty if officials display the same energy and enthusiasm in the future as they have in the past. They have been honest, courteous, reliable—in fact, all that up-to-date officials should be. They have done much for consumers. So have the newspapers by devoting space to weight and measure topics. The purchasing public has been kept informed of developments, and the spread of sentiment for honest weight and measure can be largely traced to newspapers.

PART ONE.

Review of the Work of the Year.

1916 will long be remembered because of the unusually high prices foodstuffs brought. Bread and butter, tea and coffee, sugar, milk, eggs, meats, vegetables—the necessities of life, in fact—cost more than ever before. Never in our history were prices so high. It required careful management on the part of housewives to make ends meet. Careless purchasing of food supplies was expensive and helped to add to the high cost of living. Conditions became so alarming that investigating committees were named in all sections for the purpose of bringing about relief. Beyond the registering of protests, nothing much was accomplished. Prices remained as they were or went higher. Boycotts and other schemes designed to improve conditions provided scant alleviation. It is true that wages were raised, but in many instances the amount of the increase was not sufficient to bridge the gap caused by the high cost of living.

These are facts we cannot get away from. The condition existed without a doubt, and it is referred to here for the purpose of showing that weight and measure officials recognized it and did everything possible to cope with it. Inspections were carried out more rigorously than ever. Special efforts were made to secure honest weight and measure for consumers for each dollar spent; everything known by officials was done to protect housewives. While the purchasing public may not realize how effectively it was guarded in its buying last year, it is true that superintendents were more vigilant than ever. We cannot regulate prices, but we can—and do—regulate the use of accurate weights and measures. Consumers should realize that while they are paying high prices for their supplies, they are getting full weight and full measure. Superintendents have worked hard to bring this end about, and in recognition of their efforts the fact is set forth here.

To show, in a concrete way, just what has been accomplished since the organization of this Department, the following table is appended:

Total equipment (scales, weights, measures, baskets, boxes, barrels, bottles) tested and sealed,	1,696,804
Total equipment (scales, weights and measures) condemned and confiscated,	47,831
Total number of prosecutions and convictions,	846
Total amount paid in fines,	\$16,431.25

These figures speak for themselves and substantiate what has been said of the activity of officials. Viewed from any angle, these results are highly gratifying and reflect creditably on our weight and measure officials. They show how efficiently superintendents have performed their duties. Prior to the organization of this Department, thousands of incorrect baskets and boxes were used for the sale of fruits and vegetables. These baskets rarely held the capacity claimed for them, and a campaign of confiscation was inaugurated with the result that all were taken from use. Thousands of milk bottles, too, that were short were also confiscated. Because of the comparatively short life of baskets, boxes and bottles as measuring receptacles, the total number confiscated was not included in the total mentioned above. A conservative estimate would place the figure for confiscated baskets, boxes and bottles at close to the million mark.

Taking them from use, together with the scales, weights and measures that were faulty, undoubtedly saved the people of this State hundreds of thousands of dollars. It is hardly necessary to add that all equipment confiscated was replaced with correct apparatus.

As a further illustration of wholesome adherence to duty on the part of sealers, attention is directed to the number of dealers in various lines of business who were prosecuted and convicted for not complying with the weight and measure law. In all, 846 were found guilty in five years and paid fines amounting to more than \$16,000. This is a commendable showing and goes to prove that officials have "been on the job."

FARMERS PROTECTED.

The lower section of New Jersey is famed for its fruits and vegetables. Annually the value of the products raised by the farmers run well into the millions. A tremendous amount of fertilizer is used, a large quantity of which is manure. This commodity is sold by boat and carload, and varies in price from \$1.60 to \$2.10 a ton. Previous investigations resulted in the discovery of shortages of from twenty to forty tons on the boatload and from five to ten tons on the carload. Invariably, shippers were able to effect settlements with farmers, which interfered with the efforts of superintendents to bring about permanent improvement. It is difficult to handle the reweighing of manure shipments because of inadequate facilities. One man can hardly finish a reweighing in less than two days; sometimes it takes longer and the work is arduous.

Great quantities of the manure is used in the lower counties of the State. This fact, coupled with the discovery of shortages, prompted superintendents in the affected districts to band together for the purpose of "checking up" deliveries and stamping out the short-weight practice. This was a good move, because the burden has been lightened for officials and farmers. Shippers have been made to realize that they must be careful and give honest weight. Thousands of dollars have been saved farmers through the activity of officials, and there will be no let-up. Plans for 1917 have been formulated, which call for more frequent and systematic inspections. In this way it is hoped to secure for farmers all that they pay for and to eliminate the practice of short-weighting shipments.

While most of the officials in the southern section of the State aided in the crusade waged last year, particular mention must be made of William P. Abdill, Superintendent of Gloucester County. He worked unceasingly. Traffic is heavy in this county and Mr. Abdill's efforts were praiseworthy. He was the pioneer in the movement and his investigations helped considerably to improve conditions.

COAL DELIVERIES INTERCEPTED.

If it is true that foodstuffs brought high prices during 1916, it is equally true that coal also went soaring. Poor people in the larger cities in the northern section of the State would have been at the mercy of coal-peddlers had weight and measure officials not stepped in. Many people in the larger cities are forced by circumstances to buy coal in small quantities from peddlers, who must be constantly watched by officials to insure the giving of honest weight. Much time was spent in work of this kind by superintendents and results more than justified the experiment.

In addition, all city and county officials continued to intercept regularly deliveries of coal. During 1916 4,914 deliveries were "held up" for the purpose of determining whether full weight and a certificate were being given. Some rather unusual shortages were discovered, which necessitated prosecution. But in the main, conditions were excellent, despite the fact that it was necessary to arraign twenty-four dealers. The majority were peddlers, who can hardly be classed as *bona fide* dealers.

Another plan we devised for providing honest weight in coal deliveries worked out satisfactorily. Elliott B. Holton, one of the assistants of this Department, has a motorcycle. We pur-

chased a tripod and scale that could be attached and carried on the machine. With this arrangement it was possible to intercept and reweigh deliveries wherever encountered. The necessity for driving to a scale was dispensed with, and the official was able to accomplish more and better work. It was also possible to reach many small towns quickly and learn just how dealers were complying. It supplemented the efforts of other superintendents and had a most wholesome effect generally.

This sort of inspection, we believe, is the first of its kind to be instituted anywhere and its success last year left little room to doubt its worth. Mr. Holton worked in this line from one end of the State to the other and performed fine work. He reached places that are hard to get to and did much to insure honest weight.

Attention was also given by many officials to the sale of charcoal. The Newark Department, under the able direction of John H. Sullivan, was especially active in this movement and corrected some abuses that had sprung up in the business in and around Newark.

Prosecuting and convicting dealers for selling "short-weight" deliveries of coal is not sufficient to eliminate the practice. Vigilance on the part of officials and public is necessary if the evil is to be destroyed. On the whole, dealers throughout the State are doing well, but it would be unwise to relax vigilance.

CONTENTS OF ORDER-BASKETS CHECKED.

Many consumers use the telephone to-day for shopping purposes. This is especially true of housewives purchasing food supplies. Some never go to the store. They rely upon merchants entirely for information as to quality, quantity and price. Superintendents are familiar with this state of affairs and bend their efforts towards insuring full weight and measure for those who buy in this way. During 1916, officials reweighed 63,292 packages of tea, coffee, butter, rice, sugar, dried fruits and other staples. This is an increase over the previous year of 2,773 packages and really shows what means are employed to secure the housewife all that is rightfully due. A few heavy shortages were detected that could not be excused as "mistakes." It was necessary to prosecute because the intent to defraud was easily perceptible.

Out of the total number of packages reweighed, less than 5 per cent. were found inaccurate. Not all were underweight, either. The differences found were slight and not sufficiently

serious to warrant more than a reprimand. The "checking-up" process on the part of officials is commendable and has a tendency to prevent the practice of fraud.

MOTORISTS SAFEGUARDED.

Gasoline pumps have supplanted measures to such an extent in the sale of gasoline that it is rather unusual to find the latter in use. This is not as strange as it may appear at first glance, because pumps are easier and quicker to operate and just as accurate as measures. These facts have been taken into consideration by superintendents, who have directed their efforts towards pumps to make sure that they measure correctly. Tests and inspections are made frequently for the purpose of detecting anything that may be wrong. If the pump is not measuring accurately, the sooner the fact is known and the pump adjusted the better for all concerned. Some motorists are of the opinion that the pumps, when they do get out of order, immediately work to the advantage of dealers. Such an opinion is wrong. Our experience has been that the pumps sometimes favor the dealers, sometimes consumers when they get out of order.

It is also worth mentioning that the type of equipment used for pumping purposes is constantly being improved upon. Every effort apparently is being put forth to insure accuracy in measuring gasoline, which is constantly growing in use. Officials are doing well in devoting time to this branch of inspection.

THE NET WEIGHT LAW VS. THE CONSUMER.

Briefly, the Net Weight Law, which has been in operation since the first of October, requires manufacturers of foodstuffs in packages to mark the net weight, measure or numerical count on the outside of the package. In other words, it forbids manufacturers to "weigh-in" wrappings, cartons, paper, etc. Consumers buying foodstuffs in package form to-day—and thousands never purchase in any other way—know just the quantity that they are getting for their money. They were not certain before. The act has been in operation only a short time, but its effects are already markedly beneficial. Ultimately, it will save consumers thousands of dollars, because the tendency to-day leans more and more to the sale of foodstuffs in packages. It means much to housewives to be able to see at a glance just what they are getting for their money. Already there are all kinds of teas, coffees, butter, sugar, dried fruits and vegetables—such as

beans and peas—and many other articles sold in package form. Under the Net Weight Law manufacturers must mark just what quantity is contained in the package. Merchants, too, share in the benefits of the act. It makes competition fairer and does away with the fraud that was formerly practiced.

There is no legitimate objection to the sale of food in package form. The plan has a number of advantages, chief of which must be mentioned its being sanitary. Eventually, in our opinion, most articles of food will be sold in the form of packages. The innovation may not come for a few years, but there are many evidences now pointing to the time when the method will be generally adopted. When the time does come for food to be sold exclusively in package form, our law will effectually take care of the situation.

To make the provisions of the law better understood, so that it might be complied with more readily and more intelligently, the Department compiled a list of decisions and opinions covering various phases of the act. The pamphlets are filled with interesting data on the law and how it should be construed. They have been liberally distributed by officials among those affected by the new law. The present co-operation has been largely brought about by the pamphlet, although officials also helped considerably.

STATE INSTITUTIONS VISITED.

The same careful attention that has been given to equipment in use in the various State institutions in the past was again in evidence during 1916. The need for correct standards is just as great almost in institutions as in mercantile establishments because of the large supply of foodstuffs and fuel used annually. This is understood, and we have been careful to test all of the apparatus used in the service of the State. In several instances the inspections were very timely because the standards in use had become inaccurate and were operating to the advantage of the tradesmen. The error was corrected almost as soon as discovered.

In all, twenty-one institutions were visited at least once. Some were visited oftener where such inspections were deemed necessary.

EDUCATIONAL WORK CONTINUED.

For the purpose of furthering what has already been done to educate the public—both buying and selling—the Department issued during 1916 two very interesting pamphlets. Reference

has already been made to the one which explains the operation of the Net Weight Law; the other treats of the tolerances and specifications allowable in New Jersey to manufacturers of weighing and measuring apparatus. The same deviations are permissible in this State as were adopted by the Tenth Annual Conference on Weights and Measures, held at Washington. It is realized that manufacturers should have something to guide them in the manufacture of their equipment, so that when it is completed it will comply with the law. Our booklet contains the necessary data on this important subject and has already proved its worth. Manufacturers in all sections of the country who send products into this State have been supplied with copies. New Jersey is the first State to aid them in this way.

It is felt that with this information manufacturers will turn out a higher grade of equipment that will comply more closely with the requirements of the law, instead of with the whims of dealers. Co-operation between manufacturers of weighing and measuring standards and departments of weights and measures is essential if conditions are to be permanently improved.

Nor have we neglected other ways of keeping the public informed on the latest developments. Lectures, demonstrations and exhibits of confiscated equipment have been given in all parts of the State before interested audiences. Pamphlets have been passed about gratis, and everything has been done to keep alive the subject of honest weight and measure in the home, store and workshop. In this connection it might be well to mention that officials were called upon oftener than ever before to make inspections in factories and workshops. Many firms asked for regular inspections at least once annually. The requests will be taken care of promptly and without cost to the firms making them.

This growing interest on the part of manufacturers in honest weights and measures is an unmistakable sign of progress. It leads us to believe that our missionary work along this line is certain to yield fine results.

In addition, the newspapers have helped us at various times throughout the year by giving space to articles from time to time that concerned the public. There is now no valid reason why the subject of weights and measures should not continue to progress favorably. Inspections are made by officials experienced in that line, and each county in the State maintains a Department. So do the larger cities. They work together splendidly and they should be able in the future to accomplish fine things. New Jersey is well to the fore at this time and should continue so.

RECOMMENDATIONS.

The increase in price and reduction in size and weight of loaves of bread in this State during 1916 were without a precedent. Everyone was affected. Officials connected with this Department were unable to do much to afford relief, because there was no law under which they could safely proceed. Three years ago we tried to have the Legislature pass a law which would compel bakers to mark the weight of their loaves, but the bill failed to get through.

Some bakers now voluntarily mark the weight of the loaves they bake, but the great majority do not. Last year, officials connected with this Department investigated this subject very carefully and collected valuable data from different parts of the State. Loaves of bread selling for five cents a loaf were found to vary in weight from nine and one-half ($9\frac{1}{2}$) ounces to fifteen (15) ounces; the ten-cent loaf weighed from twenty (20) ounces to thirty (30) ounces. No satisfactory reason could be found for this condition, but to many it would appear from the figures that some of the bakers—especially those who sell the heavier loaves—are transacting business at a loss. On the other hand, it may be inferred that the bakers were making exceptionally high profit. In either event it is unsound business and should not be tolerated. Quite a few bakers argue that it is impossible to enact satisfactory legislation requiring loaves of bread to be marked. We cannot agree with this point of view. We feel that a satisfactory law can be enacted that would not only protect housewives but help bakers as well.

First of all, we feel that the word "loaf" should be abolished, because it conveys no meaning of definite quantity. It is entirely too vague. If it must remain in the custom of selling bread it should be made to stand for something specific and tangible. Consumers should know when they ask for a loaf of bread just what that loaf weighs. Few have that knowledge these days, unless they "check-up" the weight on the loaves bought. Most housewives are content to take what is handed them and let it go at that. This condition should not be allowed to exist.

We feel that there should be a law requiring bakers to mark on the outside of each loaf its weight. Such a law would not inconvenience bakers and it would mean much to bread consumers and breadwinners. Under such an act purchasers could readily ascertain just what they are getting for their money. The baker who would make twelve-ounce loaves of bread would have

a hard time competing with the other baker, who makes fourteen-ounce loaves. Competition would be made fairer under such a law and prices would not go higher, we feel certain. There might be some opposition from bakers at the start, also some confusion. But these are to be looked for. They could easily be taken care of in a short time.

For some time we have been considering the advisability of recommending that the testing of gas, electric and water meters be given over to the Department of Weights and Measures. We believe that the time has come for weight and measure officials to have supervision over the testing of meters. In our opinion, it is just as important that they be tested as it is for scales, weights and measures to be tested. Properly speaking, they come within the jurisdiction of this Department. Section 1, Article 1, Chapter 201 of the Laws of 1911, reads as follows: "The words 'weights and measurers,' as used in this act, shall be deemed to mean and to include any weight, measure, * * * or any other instrument or apparatus and accessories connected therewith used in weighing or measuring any commodity, fluid or article of merchandise."

The definition is a broad one and certainly includes meters. We have refrained in the past from suggesting that the work be done by officials connected with this Department for the reason that we had other lines of inspection to claim attention. Now we have things in first-class condition, and we think we might safely be entrusted with the testing of meters.

The present system of inspection is hardly the most satisfactory one that could be devised, but in saying this we are not reflecting in any way on what the Board of Public Utility Commissioners has accomplished. The Board is doing all that is possible, and the results, while limited, are excellent.

The fault that is found, though, with the present system arises from the fact that protection is not provided for all those desirous of being protected. Many are deterred from asking for tests because they must deposit a dollar, which is returned them should the meter be working incorrectly.

We think the plan of charging consumers a fee can be dispensed with. Grocers, butchers, coal and ice men and other dealers do not pay weight and measure officials anything for having their equipment tested and sealed. Why should consumers be required to pay for having their meters tested? There is no reason why they should, and we shall try to arrange it so that they will not.

We feel that if the Department of Weights and Measures were to have the supervision of gas, electric and water meters the need for corporations making their own tests would be dispensed with. One test would do for corporation and consumer. The arrangement would be better from every point of view and much of the dissatisfaction now prevalent would be eliminated if the testing were performed by disinterested officials.

To properly take care of the work, in the event of its being given over to this Department, a large force of inspectors would be required. Weight and measure officials would hardly be able to handle all of the work, but they could help considerably. An increased appropriation would also be necessary for additional testing equipment and other expenses, such as traveling expenses and salaries. The obstacles are by no means insurmountable, because the appropriation would be made up in part from the increased revenue that would be derived from the increased number of inspections.

The companies owning the meters would pay a nominal sum for each test made, the amount to be determined later. What is now only a modest source of revenue could be made to return a very substantial sum annually. And under the arrangement we have in mind all experienced officials would be retained and their field of operations enlarged. The plan has merit because it relieves consumers and companies and provides a more efficient system of inspection than it is possible to obtain at present. Results at present are somewhat limited. We feel that they would be greater under the plan we have, and our bill will be presented to the Legislature for consideration.

The State Association of Weight and Measure Officials is strongly in favor of the bill.

By way of conclusion, let us emphasize the fact that New Jersey consumers are very well taken care of by weight and measure superintendents. A number of reforms have been brought about and more are on the way.

PART TWO.

Statistics of Inspection.

No change has been made in the arrangement of the following tables. They are presented in the same form as in other reports. They are useful for showing just what the various city and county officials are doing and are clear enough to dispense with explanations.

The tables are arranged in two divisions. The work performed in the various counties is shown in the first form, while the second is given over to municipalities. Summaries of both are also given.

As in the past, we have refrained from giving the names and occupations of those arrested and convicted on short-weighing and short-measuring charges. Such information would serve no useful purpose and may be dispensed with. It is on file, however, and may be examined by anyone wishing to do so.

SUMMARY OF TESTS MADE IN ATLANTIC COUNTY.

By E. W. STRICKLAND, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	34	3	0	37
Other platform scales,	173	1	7	181
Counter scales,	664	3	41	708
Spring balances,	331	14	34	379
Beam scales,	26	0	0	26
Computing scales,	196	5	14	215
				<u>1,546</u>
Capacity Measures.				
Dry measures,	1,065	26	0	1,091
Liquid measures,	1,318	8	0	1,326
Oil pumps,	123	5	0	128
Baskets,	6,235	4	0	6,239
				<u>8,784</u>
Linear Measures.				
Yardsticks,	105	0	0	105
				<u>105</u>
Weights.				
Avoirdupois,	4,602	36	55	4,693
				<u>4,693</u>
Aggregate equipment of all kinds tested,				<u>15,128</u>

SUMMARY OF TESTS MADE IN BERGEN COUNTY.

By J. R. O'CONNOR, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	25	0	1	26
Other platform scales,	90	0	9	99
Counter scales,	381	37	18	436
Spring balances,	199	25	25	249
Beam scales,	88	1	2	41
Computing scales,	119	0	8	127
				<u>978</u>
Capacity Measures.				
Dry measures,	488	37	0	520
Liquid measures,	494	58	0	542
Oil pumps,	50	0	9	59
Barrels,	2	0	0	2
Baskets,	111	2	0	113
Boxes,	71	0	0	71
				<u>1,807</u>
Linear Measures.				
Yardsticks,	37	2	0	39
Counter tacks,	48	3	0	51
Tapes,	2	1	0	3
				<u>93</u>
Weights.				
Avoirdupois,	2,240	149	0	2,389
				<u>2,389</u>
Aggregate equipment of all kinds tested,				<u>4,767</u>

Mr. O'Connor prosecuted a butter dealer for selling short-weight prints. A fine of \$25 and costs was imposed.

SUMMARY OF TESTS MADE IN BURLINGTON COUNTY.

By E. T. HAINES, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Suspension scales,	7	0	0	7
Hopper scales,	3	0	0	3
Wagon scales,	78	6	1	85
Other platform scales,	146	9	0	155
Counter scales,	428	8	2	438
Spring balances,	122	2	1	125
Beam scales,	54	0	0	54
Computing scales,	86	0	4	90
Slot personal scales,	9	0	0	9
Miscellaneous,	62	0	0	62
				<u>1,023</u>
Capacity Measures.				
Dry measures,	492	4	0	496
Liquid measures,	432	7	0	439
Automatic gauges,	92	2	17	111
Baskets,	0	84	0	84
Boxes,	0	42	0	42
				<u>1,172</u>
Linear Measures.				
Yardsticks,	138	0	0	138
Counter tacks,	64	0	0	64
Tapes,	17	0	0	17
				<u>217</u>
Weights.				
Avoirdupois,	2,740	0	0	2,740
				<u>2,740</u>
Aggregate equipment of all kinds tested,				<u>5,157</u>

SUMMARY OF TESTS MADE IN CAMDEN COUNTY.

By G. E. STARN, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	1	0	0	1
Wagon scales,	21	1	0	22
Other platform scales,	21	0	0	0
Counter scales,	200	0	0	200
Spring balances,	140	5	0	145
Computing scales,	112	2	0	114
				<u>542</u>
Capacity Measures.				
Dry measures,	175	14	0	189
Liquid measures,	165	4	0	169
Oil pumps,	24	1	0	25
Baskets,	7,500	0	0	7,500
Small fruit baskets and berry boxes,	12,000	0	0	12,000
				<u>19,883</u>
Linear Measures.				
Yardsticks,	4	0	0	4
Tapes,	12	0	0	12
				<u>16</u>
Weights.				
Avoirdupois,	1,257	3	0	1,260
				<u>1,260</u>
Aggregate equipment of all kinds tested,				<u>21,701</u>

SUMMARY OF TESTS MADE IN CAPE MAY COUNTY.

By D. W. RODAN, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Railroad track scales,	2	0	0	2
Wagon scales,	29	0	7	36
Other platform scales,	107	2	13	122
Counter scales,	384	7	22	413
Spring balances,	198	5	14	217
Beam scales,	5	0	0	5
Computing scales,	61	1	4	62
				<u>857</u>
Capacity Measures.				
Dry measures,	473	11	0	484
Liquid measures,	579	12	0	581
Glass graduates,	27	0	0	27
Automatic gauges,	37	0	6	43
Oil pumps,	73	0	14	87
Baskets,	2,804	0	0	2,804
Small fruit baskets,	209	0	0	209
Boxes,	62	0	0	62
				<u>4,297</u>
Linear Measures.				
Yardsticks,	53	0	0	53
Counter tacks,	11	0	0	11
				<u>64</u>
Weights.				
Avoirdupois,	2,004	26	42	2,072
				<u>2,072</u>
Aggregate equipment of all kinds tested,				<u>7,290</u>

SUMMARY OF TESTS MADE IN CUMBERLAND COUNTY.

By C. H. FORT, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	2	0	0	2
Wagon scales,	131	3	19	153
Other platform scales,	98	6	22	126
Counter scales,	492	13	45	550
Spring balances,	78	53	0	129
Beam scales,	39	2	7	48
Computing scales,	94	1	88	183
				<u>1,141</u>
Capacity Measures.				
Dry measures,	614	64	0	678
Liquid measures,	537	99	0	636
Automatic gauges,	34	2	14	50
Oil pumps,	81	7	4	92
Barrels,	72	5	0	77
Baskets,	967	69	0	1,066
Small fruit baskets,	117	19	0	136
Boxes,	49	11	0	60
				<u>2,785</u>
Linear Measures.				
Yardsticks,	82	12	0	94
Counter tacks,	7	21	0	28
Tapes,	16	3	0	19
				<u>141</u>
Weights.				
Avoirdupois,	2,734	114	25	2,873
				<u>2,878</u>
Aggregate equipment of all kinds tested,				6,940

Mr. Fort had seven prosecutions. Two cases were dismissed, while the others resulted in convictions. Fines aggregating \$80 were collected.

SUMMARY OF TESTS MADE IN ESSEX COUNTY.

By H. B. HOLCOMBE, Superintendent, and assistants.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	83	8	0	91
Other platform scales,	433	0	4	437
Counter scales,	2,577	6	12	2,595
Spring balances,	981	13	16	1,000
Beam scales,	252	0	0	252
Computing scales,	509	0	2	511
Prescription scales,	65	0	0	65
				<u>4,961</u>
Capacity Measures.				
Dry measures,	4,048	8	0	4,056
Liquid measures,	1,602	3	0	1,605
Oil pumps,	37	0	0	37
Baskets,	3,225	5	0	3,230
				<u>8,928</u>
Linear Measures.				
Yardsticks,	73	0	0	73
Counter tacks,	1,118	0	8	1,126
Tapes,	10	3	0	13
				<u>1,212</u>
Weights.				
Avoirdupois,	12,896	40	0	12,936
Troy,	100	11	0	111
Apothecary,	793	59	0	852
Metric,	438	4	0	442
				<u>14,341</u>
Aggregate equipment of all kinds tested,				29,442

The Essex County Department reported four prosecutions and secured convictions in all. Decision was reserved in one case; the remaining offenders paid fines amounting to \$60.

SUMMARY OF TESTS MADE IN GLOUCESTER COUNTY. By W. P. ABDILL, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	70	4	8	82
Other platform scales,	130	4	16	150
Counter scales,	245	2	13	260
Spring balances,	69	2	0	71
Beam scales,	5	2	0	7
Computing scales,	89	3	0	92
				<u>662</u>
Capacity Measures.				
Dry measures,	335	12	0	347
Liquid measures,	618	3	0	621
Oil pumps,	75	3	15	93
Baskets,	414	0	0	414
Boxes,	750	330	0	1,080
				<u>2,555</u>
Linear Measures.				
Yardsticks,	85	0	0	85
				<u>85</u>
Weights.				
Avoirdupois,	2,308	0	7	2,319
				<u>2,319</u>
Aggregate equipment of all kinds tested,				<u>5,621</u>

SUMMARY OF TESTS MADE IN HUDSON COUNTY.

By T. J. WALDRON, Superintendent, assisted by T. GIRSHAM.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	6	0	1	7
Wagon scales,	34	0	5	39
Other platform scales,	81	1	6	88
Counter scales,	534	16	25	575
Spring balances,	401	38	21	460
Beam scales,	16	0	0	16
Computing scales,	473	33	20	526
Slot personal scales,	19	1	0	20
Prescription scales,	9	0	0	9
				<u>1,740</u>
Capacity Measures.				
Dry measures,	498	26	0	524
Liquid measures,	792	15	0	807
Oil pumps,	71	2	15	88
Baskets,	3,974	117	0	4,091
Boxes,	480	0	0	480
				<u>5,990</u>
Linear Measures.				
Yardsticks,	91	3	0	94
Counter tacks,	106	2	0	108
Tapes,	25	2	0	27
				<u>229</u>
Weights.				
Avoirdupois,	2,857	39	0	2,896
Apothecary,	138	8	0	146
				<u>3,042</u>
Aggregate equipment of all kinds tested,				<u>11,001</u>

Mr. Waldron reported sixteen prosecutions. Six dealers had sentence suspended; the remaining ten were convicted and paid fines aggregating \$48.

SUMMARY OF TESTS MADE IN HUNTERDON COUNTY.

By E. W. SUTTON, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	4	0	0	4
Wagon scales,	75	0	0	75
Other platform scales,	371	1	0	372
Counter scales,	364	6	0	370
Spring balances,	68	1	0	69
Beam scales,	28	0	0	28
Computing scales,	57	0	0	57
Suspension scales,	10	0	0	10
				<u>968</u>
Capacity Measures.				
Dry measures,	610	15	0	625
Liquid measures,	1,064	6	0	1,060
Glass graduates,	135	2	0	137
Automatic gauges,				
Oil pumps,	270	15	0	285
Boxes,				
				<u>2,107</u>
Linear Measures.				
Yardsticks,	110	21	0	131
Counter tacks,	1,368	15	0	1,383
				<u>1,514</u>
Weights.				
Avoirdupois,	8,642	25	0	8,667
				<u>8,667</u>
Aggregate equipment of all kinds tested,				<u>8,271</u>

Mr. Sutton had two prosecutions and convictions. Fines amounting to \$20 were imposed.

SUMMARY OF TESTS MADE IN MERCER COUNTY.

By J. H. MULHERON, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	2	0	0	2
Wagon scales,	63	4	20	87
Other platform scales,	192	0	46	238
Counter scales,	465	5	147	617
Spring balances,	121	4	9	134
Beam scales,	24	0	3	27
Computing scales,	65	0	2	67
				<u>1,172</u>
Capacity Measures.				
Dry measures,	1,190	15	0	1,205
Liquid measures,	1,771	5	0	1,776
Oil pumps,	83	5	3	91
Baskets,	4,322	0	0	4,322
Small fruit baskets,	1,987	0	0	1,987
				<u>9,381</u>
Linear Measures.				
Yardsticks,	39	0	0	39
Counter tacks,	31	0	0	31
Tapes,	17	0	0	17
				<u>87</u>
Weights.				
Avoirdupois,	2,780	21	0	2,801
				<u>2,801</u>
Aggregate equipment of all kinds tested,				<u>13,441</u>

SUMMARY OF TESTS MADE IN MIDDLESEX COUNTY.

By N. ROBINS, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	19	0	0	19
Other platform scales,	359	4	7	370
Counter scales,	1,064	6	10	1,070
Spring balances,	420	7	3	430
Beam scales,	78	0	2	80
Computing scales,	358	0	33	391
				<u>2,360.</u>
Capacity Measures.				
Dry measures,	1,812	0	0	1,812
Liquid measures,	631	0	0	631
Oil pumps,	132	2	0	134
Baskets,	183	0	0	183
				<u>2,760</u>
Weights.				
Avoirdupois,	5,778	130	0	5,908.
				<u>5,908</u>
Aggregate equipment of all kinds tested,				<u>11,028</u>

Mr. Robins reported two prosecutions and convictions. Fines amounting to \$20 were imposed.

SUMMARY OF TESTS MADE IN MONMOUTH COUNTY.

By T. WYNCOOP, Superintendent.

Assisted by J. H. VAN MATER and J. H. FITZGERALD.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Railroad track scales,	10	0	0	10
Hopper scales,	9	0	0	9
Wagon scales,	128	0	0	128
Other platform scales,	523	6	6	535
Counter scales,	1,005	26	64	1,095
Spring balances,	495	37	60	592
Beam scales,	80	2	0	82
Computing scales,	180	10	19	209
Miscellaneous,	14	1	0	15
				<u>2,675</u>
Capacity Measures.				
Dry measures,	1,332	27	3	1,362
Liquid measures,	1,517	12	1	1,530
Automatic gauges,	223	18	21	257
Baskets,	6,686	92	0	6,778
Boxes,	340	0	0	340
Miscellaneous,	260	0	0	260
				<u>10,527</u>
Linear Measures.				
Yardsticks,	62	5	0	67
Counter tacks,	381	3	0	384
Tapes,	0	1	0	1
				<u>452</u>
Weights.				
Avoirdupois,	5,718	30	45	5,798
				<u>5,798</u>
Aggregate equipment of all kinds tested,				<u>19,447</u>

SUMMARY OF TESTS MADE IN MORRIS COUNTY.

By H. S. WORMAN, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	110	0	3	113
Other platform scales,	219	0	10	229
Counter scales,	493	10	20	523
Spring balances,	210	5	10	225
Beam scales,	12	0	0	12
Computing scales,	165	0	12	177
				1,279
Capacity Measures.				
Dry measures,	990	20	0	1,010
Liquid measures,	825	50	0	875
Automatic gauges,	134	0	20	154
Baskets,	1,517	95	0	1,612
Boxes,	1,752	0	0	1,752
				5,408
Linear Measures.				
Yardsticks,	174	20	0	194
Counter tacks,	378	0	16	394
Tapes,	163	10	0	173
				761
Weights.				
Avoldupols,	4,476	102	25	4,603
				4,608
Aggregate equipment of all kinds tested,				12,046

Mr. Worman reported one prosecution and conviction. A fine of \$10 was imposed.

SUMMARY OF TESTS MADE IN OCEAN COUNTY.

By R. C. SPACKMAN, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	41	0	6	47
Other platform scales,	301	2	5	308
Counter scales,	492	10	20	522
Spring balances,	310	3	10	323
Beam scales,	222	6	6	234
Computing scales,	281	3	4	288
Slot personal scales,	10	3	0	13
Prescription scales,	128	0	0	128
Miscellaneous,	61	9	10	80
				1,933
Capacity Measures.				
Dry measures,	810	20	0	830
Liquid measures,	805	18	0	823
Glass graduates,	60	0	0	60
Automatic gauges,	207	3	18	228
Oil pumps,	101	2	19	122
Barrels,	100	0	0	100
Baskets,	500	28	0	528
Small fruit baskets,	200	41	0	241
				2,932
Linear Measures.				
Yardsticks,	605	0	10	615
Counter tacks,	141	0	21	162
Tapes,	200	0	6	215
Miscellaneous,	60	11	20	91
				1,083
Weights.				
Avoldupols,	1,810	10	20	1,840
Troy,	55	2	0	57
				1,897
Aggregate equipment of all kinds tested,				7,845

- SUMMARY OF TESTS MADE IN PASSAIC COUNTY.

By H. ROSENFELT, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	38	2	4	44
Other platform scales,	100	0	18	118
Counter scales,	442	15	41	498
Spring balances,	449	26	61	536
Beam scales,	41	1	4	46
Computing scales,	220	0	21	241
Miscellaneous,	112	14	6	132
				1,615
Capacity Measures.				
Dry measures,	863	73	0	936
Liquid measures,	628	46	0	674
Oil pumps,	121	2	24	147
				1,757
Linear Measures.				
Yardsticks,	124	5	0	129
Counter tacks,	64	0	42	106
Tapes,	42	12	0	54
				289
Weights.				
Avoirdupois,	1,657	102	78	1,837
				1,837
Aggregate equipment of all kinds tested,				5,498

Mr. Rosenfelt reported three prosecutions and convictions. Fines aggregating \$90 were imposed.

SUMMARY OF TESTS MADE IN SALEM COUNTY.

By H. C. HITCHNER, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	3	1	0	4
Wagon scales,	67	4	11	82
Other platform scales,	122	2	19	143
Counter scales,	178	8	27	213
Spring balances,	89	5	9	103
Beam scales,	18	0	0	18
Computing scales,	53	2	5	60
				623
Capacity Measures.				
Dry measures,	213	17	0	230
Liquid measures,	305	6	0	311
Oil pumps,	80	1	15	106
Baskets,	91	30	0	121
Small fruit baskets,	145	0	0	145
Boxes,	84	0	0	84
				996
Linear Measures.				
Yardsticks,	49	2	0	51
Counter tacks,	10	0	0	10
Tapes,	6	0	0	6
				67
Weights.				
Avoirdupois,	1,389	41	6	1,436
				1,436
Aggregate equipment of all kinds tested,				3,122

SUMMARY OF TESTS MADE IN SOMERSET COUNTY.

By T. P. GALLAGHER, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Railroad track scales,	5	0	2	7
Hopper scales,	7	0	3	10
Wagon scales,	308	11	51	370
Other platform scales,	582	20	68	670
Counter scales,	1,304	57	38	1,399
Spring balances,	410	32	87	529
Beam scales,	178	12	21	211
Computing scales,	264	16	81	361
Slot personal scales,	90	8	7	105
Prescription scales,	20	0	0	20
				<hr/> 3,682
Capacity Measures.				
Dry measures,	1,610	108	0	1,718
Liquid measures,	2,408	91	0	2,499
Glass graduates,	16	0	0	16
Automatic gauges,	212	7	12	231
Oil pumps,	51	4	3	58
Baskets,	2,887	480	0	3,367
Small fruit baskets,	506	84	0	590
Boxes,	301	0	0	301
Miscellaneous,	91	22	0	113
				<hr/> 8,893
Linear Measures.				
Yardsticks,	408	9	0	417
Counter tacks,	387	0	0	387
Tapes,	73	17	0	90
				<hr/> 894
Weights.				
Avordupois,	5,804	18	12	5,834
Troy,	7	8	0	10
Apothecary,	180	64	0	244
Miscellaneous,	17	0	0	17
				<hr/> 6,105
Aggregate equipment of all kinds tested,				19,574

Mr. Gallagher had two prosecutions, both of which resulted in convictions. Fines amounting to \$35 were imposed.

SUMMARY OF TESTS MADE IN SUSSEX COUNTY,

By R. L. SLATER, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	20	3	4	27
Other platform scales,	153	1	15	169
Counter scales,	257	12	6	275
Spring balances,	34	8	0	42
Beam scales,	14	0	0	14
Computing scales,	44	3	0	47
				<hr/> 574
Capacity Measures.				
Dry measures,	422	15	0	437
Liquid measures,	275	5	0	280
Automatic gauges,	49	3	0	52
				<hr/> 769
Linear Measures.				
Yardsticks,	31	11	0	42
Counter tacks,	314	11	76	401
Tapes,	0	1	0	1
				<hr/> 444
Weights.				
Avordupois,	1,584	19	62	1,665
				<hr/> 1,665
Aggregate equipment of all kinds tested,				8,452

Mr. Slater had two prosecutions, both of which resulted in convictions. Fines amounting to \$50 and costs were imposed.

SUMMARY OF TESTS MADE IN UNION COUNTY.

By ISAAC SEELEY, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Railroad track scales,	1	0	1	2
Hopper scales,	5	1	0	6
Wagon scales,	62	9	0	71
Other platform scales,	248	19	11	278
Counter scales,	995	32	26	1,053
Spring balances,	335	37	18	390
Beam scales,	68	5	2	75
Computing scales,	168	6	21	195
Prescription scales,	64	1	1	66
Metric scales,	3	0	0	3
Miscellaneous,	4	1	0	5
				2,144
Capacity Measures.				
Dry measures,	1,291	25	0	1,316
Liquid measures,	1,238	63	0	1,301
Oil pumps,	114	29	2	145
Baskets,	175	79	0	254
Boxes,	322	0	0	322
				3,338
Linear Measures.				
Yardsticks,	62	7	0	69
Counter tacks,	536	1	3	540
Tapes,	2	10	0	12
				621
Weights.				
Avordupois,	5,676	164	11	5,851
Apothecary,	74	2	0	76
Metric,	217	67	0	284
				6,211
Aggregate equipment of all kinds tested,				12,314

SUMMARY OF TESTS MADE IN WARREN COUNTY.

By A. RAUB, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	3	0	0	3
Wagon scales,	64	1	0	65
Other platform scales,	215	1	0	216
Counter scales,	308	1	0	309
Spring balances,	107	7	0	114
Beam scales,	70	2	0	72
Computing scales,	79	0	0	79
				858
Capacity Measures.				
Dry measures,	881	15	0	896
Liquid measures,	474	0	0	474
Automatic gauges,	24	1	0	25
Baskets,	2,345	60	0	2,405
				3,800
Linear Measures.				
Yardsticks,	164	0	0	164
Tapes,	3	0	0	3
				167
Weights.				
Avordupois,	2,455	0	0	2,455
				2,455
Aggregate equipment of all kinds tested,				7,280

Mr. Raub reported three prosecutions. Convictions in all were obtained and fines amounting to \$26.50 were collected.

TESTS MADE, NUMBER OF PROSECUTIONS AND AMOUNT
PAID IN FINES IN COUNTIES OF NEW JERSEY.

Counties.	Weighting Machines.	Capacity Measures.	Linear Measures.	Weights.	Prosecutions.	Fines.
Atlantic,	1,546	8,784	106	4,083	0	\$0.00
Bergen,	978	1,307	93	2,389	1	25.00
Burlington,	1,028	1,172	217	2,740	0	0.00
Camden,	542	19,893	16	1,260	0	0.00
Cape May,	857	4,297	64	2,072	0	0.00
Cumberland,	1,141	2,785	141	2,873	7	0.00
Essex,	4,961	8,928	1,212	14,341	4	60.00
Gloucester,	692	2,555	85	2,319	0	0.00
Hudson,	1,740	5,990	229	3,042	16	48.00
Hunterdon,	983	2,107	1,514	3,667	2	20.00
Mercer,	1,172	9,381	87	2,801	0	0.00
Middlesex,	2,360	2,760	0	5,908	2	20.00
Monmouth,	2,675	10,527	452	5,793	0	0.00
Morris,	1,279	5,403	761	4,693	1	10.00
Ocean,	1,932	2,922	1,083	1,897	0	0.00
Passaic,	1,615	1,757	289	1,837	3	60.00
Salem,	623	886	67	1,436	0	0.00
Somerset,	3,632	8,863	894	6,106	2	55.00
Sussex,	574	769	444	1,965	2	50.00
Union,	2,144	3,338	621	6,211	0	0.00
Warren,	858	3,800	167	2,455	3	16.50
	33,353	108,464	8,541	80,107	43	\$444.50

SUMMARY OF TESTS MADE IN THE CITY OF BAYONNE.

By HARRY MAINHARD, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	13	0	4	17
Other platform scales,	118	0	7	125
Counter scales,	417	8	6	431
Spring balances,	618	15	0	633
Beam scales,	28	0	0	28
Computing scales,	210	0	0	210
Slot personal scales,	4	0	0	4
Prescription scales,	3	0	0	3
				<hr/> 1,451
Capacity Measures.				
Dry measures,	760	42	0	802
Liquid measures,	67	0	0	67
Oil pumps,	22	0	0	22
Baskets,	350	80	0	430
				<hr/> 1,321
Weights.				
Avoirdupois,	2,700	120	0	2,820
Troy,	22	0	0	22
Apothecary,	12	0	0	12
Metric,	70	0	0	70
				<hr/> 2,924
Aggregate equipment of all kinds tested,				<hr/> 5,696

Mr. Mainhard prosecuted three dealers for infractions of the weights and measures act. They were all convicted and paid fines amounting to \$80.

SUMMARY OF TESTS MADE IN THE CITY OF CAMDEN.

By G. G. KRUCK, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Railroad track scales,	4	0	2	6
Hopper scales,	4	0	0	4
Wagon scales,	40	2	18	60
Other platform scales,	160	2	45	207
Counter scales,	400	8	60	468
Spring balances,	600	8	40	648
Beam scales,	22	1	2	25
Computing scales,	350	12	14	376
Miscellaneous,	40	7	2	49
				<hr/> 1,843
Capacity Measures.				
Dry measures,	2,200	60	0	2,260
Liquid measures,	700	0	0	700
Oil pumps,	84	5	2	91
Baskets,	8,000	200	0	8,200
Small fruit baskets,	150	20	0	170
Boxes,	1,500	200	0	1,700
				<hr/> 13,121
Weights.				
Avoirdupois,	5,432	187	0	5,619
				<hr/> 5,619
Aggregate equipment of all kinds tested,				<hr/> 20,583

Mr. Kruck prosecuted four violators of the weight and measure law. One dealer escaped with a reprimand. The others paid fines amounting to \$30.

SUMMARY OF TESTS MADE IN THE CITY OF ELIZABETH.

By W. J. BENDER, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Railroad track scales,	7	0	0	7
Hopper scales,	4	0	0	4
Wagon scales,	42	8	0	50
Other platform scales,	226	3	0	229
Counter scales,	840	22	1	863
Spring balances,	575	37	2	614
Beam scales,	94	4	0	98
Computing scales,	344	13	0	357
				<hr/> 2,222
Capacity Measures.				
Dry measures,	2,355	0	12	2,367
Liquid measures,	2,161	0	0	2,161
Oil pumps,	43	0	0	43
Baskets,	3,373	111	0	3,484
				<hr/> 8,055
Linear Measures.				
Yardsticks,	159	0	0	159
Counter tacks,	200	0	0	200
				<hr/> 419
Weights.				
Avoldrups,	4,981	0	21	4,982
Troy,	78	0	0	78
Apothecary,	642	0	0	642
Metric,	385	0	0	385
				<hr/> 6,057
Aggregate equipment of all kinds tested,				16,758

Mr. Bender reported four prosecutions. One offender succeeded in having sentence suspended; the remaining three paid fines amounting to \$25.

SUMMARY OF TESTS MADE IN TOWN OF ENGLEWOOD.

By J. E. FITZGERALD, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	6	1	0	7
Other platform scales,	8	0	8	16
Counter scales,	24	0	6	30
Spring balances,	33	1	0	34
Computing scales,	31	2	12	45
Slot personal scales,	2	1	0	3
Prescription scales,	4	0	0	4
				<hr/> 139
Capacity Measures.				
Dry measures,	690	21	0	701
Liquid measures,	90	2	0	92
Oil pumps,	8	0	0	8
Barrels,	3	0	0	3
Baskets,	140	7	0	147
Small fruit baskets,	290	8	0	298
				<hr/> 1,249
Linear Measures.				
Yardsticks,	6	0	0	6
Counter tacks,	3	0	0	3
				<hr/> 9
Weights.				
Avoldrups,	110	16	0	126
Troy,	18	0	0	18
				<hr/> 144
Aggregate equipment of all kinds tested,				1,541

Mr. Fitzgerald prosecuted three dealers for violating the law. Fines amounting to \$25 were imposed.

SUMMARY OF TESTS MADE IN THE CITY OF HOBOKEN.

By D. J. GRAY, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	7	0	0	7
Other platform scales,	66	2	6	74
Counter scales,	547	40	39	626
Spring balances,	301	50	16	367
Beam scales,	22	0	0	22
Computing scales,	137	8	13	158
				<hr/> 1,254
Capacity Measures.				
Dry measures,	151	3	0	154
Liquid measures,	591	25	0	616
Oil pumps,	15	0	0	15
				<hr/> 785
Linear Measures.				
Yardsticks,	53	1	0	54
Counter tacks,	89	0	0	89
Tapes,	3	3	0	6
				<hr/> 149
Weights.				
Avordupois,	2,316	207	10	2,533
				<hr/> 2,538
Aggregate equipment of all kinds tested,				4,721

Mr. Gray reported nine prosecutions. He secured convictions in three cases. Offenders paid fines amounting to \$22.

SUMMARY OF TESTS MADE IN THE CITY OF JERSEY CITY.

By J. S. BURKE, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	42	0	0	42
Other platform scales,	61	0	0	61
Counter scales,	1,604	71	63	1,738
Spring balances,	980	57	18	1,055
Beam scales,	63	0	0	63
Computing scales,	756	18	11	785
				<hr/> 3,749
Capacity Measures.				
Dry measures,	902	38	0	940
Liquid measures,	2,207	53	0	2,260
Oil pumps,	67	0	0	67
Baskets,	550	57	0	607
Small fruit baskets,	110	0	0	110
				<hr/> 3,984
Linear Measures.				
Yardsticks,	15	0	0	15
				<hr/> 15
Weights.				
Avordupois,	3,912	85	0	3,997
				<hr/> 3,997
Aggregate equipment of all kinds tested,				11,745

Five prosecutions were reported by Mr. Burke. Complaints in two cases were dismissed; the other three offenders were convicted and paid fines amounting to \$55.

SUMMARY OF TESTS MADE IN THE TOWN OF KEARNY.

By J. D. CASTLES, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	9	0	2	11
Other platform scales,	12	0	3	15
Counter scales,	95	2	8	105
Spring balances,	108	3	9	120
Beam scales,	8	0	2	10
Computing scales,	9	0	9	9
				<u>270</u>
Capacity Measures.				
Dry measures,	76	4	0	80
Liquid measures,	18	0	0	18
Oil pumps,	10	0	3	18
Baskets,	18	6	0	24
Small fruit baskets,	12	0	0	12
				<u>147</u>
Linear Measures.				
Counter tacks,	4	0	4	8
				<u>8</u>
Weights.				
Avoirdupois,	170	6	8	184
Apothecary,	170	0	10	180
				<u>364</u>
Aggregate equipment of all kinds tested,				<u>789</u>

SUMMARY OF TESTS MADE IN THE CITY OF NEWARK.

By J. H. SULLIVAN, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	103	34	9	146
Other platform scales,	653	92	81	826
Counter scales,	2,787	44	220	3,051
Spring balances,	1,857	90	73	2,020
Beam scales,	193	10	38	241
Computing scales,	539	19	49	607
Prescription scales,	3	0	0	3
Miscellaneous,	28	1	5	34
				<u>6,923</u>
Capacity Measures.				
Dry measures,	4,716	0	0	4,716
Liquid measures,	3,604	3	1	3,608
Oil pumps,	60	9	17	86
Barrels,	10	0	0	10
Baskets,	804	2	0	806
				<u>9,226</u>
Linear Measures.				
Yardsticks,	273	1	0	274
Counter tacks,	523	0	2	525
Tapes,	3	0	0	3
				<u>802</u>
Weights.				
Avoirdupois,	12,067	20	18	12,105
Troy,	26	0	4	30
Apothecary,	28	0	8	36
Metric,	27	0	6	33
				<u>12,204</u>
Aggregate equipment of all kinds tested,				<u>29,160</u>

Mr. Sullivan prosecuted eleven dealers for violating the weight and measure law. All were convicted and fines amounting to \$320 were imposed.

SUMMARY OF TESTS MADE IN THE TOWN OF NUTLEY.

By GEORGE HAWKESWORTH, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	28	1	0	29
Other platform scales,	36	2	0	38
Counter scales,	210	5	5	220
Spring balances,	42	1	0	43
Beam scales,	12	0	0	12
Computing scales,	18	1	1	20
Prescription scales,	12	0	0	12
				374
Capacity Measures.				
Dry measures,	139	7	0	146
Liquid measures,	25	0	0	25
Oil pumps,	42	0	0	42
Baskets,	389	72	0	411
				624
Linear Measures.				
Yardsticks,	25	0	0	25
Counter tacks,	12	0	0	12
Tapes,	6	0	0	6
				43
Aggregate equipment of all kinds tested,				1,041

SUMMARY OF TESTS MADE IN THE CITY OF ORANGE.

By J. H. MCCARTHY, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Railroad track scales,	1	0	0	1
Wagon scales,	17	0	0	17
Other platform scales,	84	0	0	84
Counter scales,	355	7	0	362
Spring balances,	159	9	0	168
Beam scales,	18	0	0	18
Computing scales,	37	0	0	37
Slot personal scales,	11	0	0	11
Prescription scales,	19	0	0	19
				717
Capacity Measures.				
Dry measures,	421	2	0	423
Liquid measures,	368	4	0	372
Glass graduates,	14	0	0	14
Oil pumps,	14	0	0	14
Baskets,	375	20	0	395
Small fruit baskets,	71	4	0	75
Boxes,	30	0	0	30
				1,323
Linear Measures.				
Yardsticks,	31	1	0	32
Counter tacks,	57	2	0	59
Tapes,	6	0	0	6
				97
Weights.				
Avoldrups,	2,073	5	0	2,078
				2,078
Aggregate equipment of all kinds tested,				4,215

Mr. McCarthy prosecuted four merchants for violating weights and measures act. The outcome of three cases has not been decided. The dealer convicted paid a fine of \$10.

SUMMARY OF TESTS MADE IN THE CITY OF PASSAIC.

By P. J. GALLAGHER, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	16	3	0	19
Other platform scales,	292	16	0	308
Counter scales,	1,926	14	3	1,943
Spring balances,	1,854	58	26	1,938
Beam scales,	824	2	0	826
Computing scales,	598	2	6	606
Prescription scales,	51	10	0	61
Miscellaneous,	163	9	0	172
				<hr/> 5,873
Capacity Measures.				
Dry measures,	2,111	39	0	2,150
Liquid measures,	1,509	43	0	1,612
Oil pumps,	23	5	0	28
Baskets,	151	15	0	166
Small fruit baskets,	23	8	0	31
				<hr/> 3,967
Linear Measures.				
Yardsticks,	123	4	0	127
Counter tacks,	62	2	0	64
Tapes,	15	3	0	18
				<hr/> 209
Weights.				
Avordupois,	4,318	145	0	4,463
Troy,	46	19	0	65
Apothecary,	78	3	0	81
				<hr/> 4,609
Aggregate equipment of all kinds tested,				14,678

Mr. Gallagher reported sixteen prosecutions, fourteen of which were successful. Two cases were dismissed. The remaining dealers convicted paid fines amounting to \$106.

SUMMARY OF TESTS MADE IN THE CITY OF PATERSON.

By T. J. McCran, Superintendent.

Equipment Tested.	Scaled.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Wagon scales,	42	3	5	50
Other platform scales,	114	3	6	123
Counter scales,	941	39	12	992
Spring balances,	412	10	14	436
Beam scales,	42	0	0	42
Computing scales,	316	0	8	324
Miscellaneous,	144	20	44	208
				<hr/> 2,175
Capacity Measures.				
Dry measures,	1,214	114	0	1,328
Liquid measures,	862	24	0	1,886
Oil pumps,	68	0	12	80
Baskets,	690	104	0	794
Small fruit baskets,	320	40	0	360
				<hr/> 3,448
Linear Measures.				
Yardsticks,	27	0	0	27
Counter tacks,	92	0	12	104
Tapes,	38	9	0	47
				<hr/> 178
Weights.				
Avordupois,	2,126	126	0	2,252
				<hr/> 2,252
Aggregate equipment of all kinds tested,				8,053

SUMMARY OF TESTS MADE IN THE CITY OF PERTH AMBOY.

By HENRY TOFT, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	1	0	0	1
Wagon scales,	29	1	1	31
Other platform scales,	67	0	4	71
Counter scales,	213	2	11	226
Spring balances,	315	11	30	356
Beam scales,	25	1	1	27
Computing scales,	223	17	0	240
				962
Capacity Measures.				
Dry measures,	63	0	0	63
Liquid measures,	200	5	0	205
Oil pumps,	23	0	3	26
				294
Linear Measures.				
Yardsticks,	14	1	0	15
Counter tacks,	188	0	1	189
Tapes,	2	0	0	2
				206
Weights.				
Avordupois,	302	9	6	407
				407
Aggregate equipment of all kinds tested,				1,859

Mr. Toft had secured convictions in eight cases out of ten prosecuted. Fines amounting to \$90 were imposed. Two offenders were discharged with reprimands.

SUMMARY OF TESTS MADE IN THE CITY OF TRENTON.

By J. E. O'DONOVAN, Superintendent.

Equipment Tested.	Sealed.	Condemned.	Adjusted.	Total.
Weighing Machines.				
Hopper scales,	3	0	0	3
Wagon scales,	105	3	0	108
Other platform scales,	187	9	5	201
Counter scales,	973	17	187	1,177
Spring balances,	511	28	45	584
Beam scales,	187	1	11	149
Computing scales,	209	3	57	269
Prescription scales,	7	0	2	9
Metric scales,	1	0	1	2
				2,502
Capacity Measures.				
Dry measures,	2,319	3	0	2,322
Liquid measures,	1,807	9	0	1,816
Automatic gauges,	36	3	5	44
Oil pumps,	24	0	3	27
Barrels,	3	1	0	4
				4,213
Linear Measures.				
Tapes,	9	2	0	11
				11
Weights.				
Avordupois,	5,310	24	58	5,390
Apothecary,	115	11	0	126
Metric,	32	0	0	32
				5,548
Aggregate equipment of all kinds tested,				12,274

Mr. O'Donovan succeeded in securing convictions in five cases prosecuted. \$170 in fines were imposed.

TESTS MADE, NUMBER OF PROSECUTIONS AND AMOUNT
PAID IN FINES IN CITIES OF NEW JERSEY.

Cities.	Weighing Machines.	Capacity Measures.	Linear Measures.	Weights.	Prosecutions.	Fines.
Bayonne,	1,451	1,821	0	2,924	3	\$ 80
Camden,	1,848	13,121	0	5,619	4	30
Elizabeth,	2,222	8,065	419	6,067	4	26
Englewood,	139	1,240	9	144	8	26
Hoboken,	1,264	768	149	2,533	9	22
Jersey City,	8,749	3,984	15	3,997	5	65
Kearny,	270	147	8	364	0	0
Newark,	6,926	9,226	802	12,204	11	820
Nutley,	374	624	43	0	0	0
Orange,	717	1,323	97	2,078	4	10
Passaic,	5,873	3,987	269	4,606	16	106
Paterson,	2,176	3,448	178	2,262	0	0
Perth Amboy,	962	264	206	407	10	80
Trenton,	2,602	4,213	11	5,548	5	170
	80,449	53,777	2,146	48,738	74	\$828
Aggregate equipment of all kinds tested in cities and counties,						
Aggregate prosecutions,						
Aggregate amount of fines,						
				386,573		
				117		
				\$1,367.50		

Document No. 43

Annual Report

OF THE

**New Jersey Commission
for the Blind**

For the Year 1916

ANNUAL REPORT

OF THE

NEW JERSEY COMMISSION
FOR THE BLIND

For the Year Ending October 31

1916

Commission Headquarters, 54 James St., Newark, N. J.

TRENTON, N. J.
MACCRELLISH & QUIGLEY Co., State Printers

1917

NEW JERSEY COMMISSION FOR THE BLIND

54 James Street, Newark, N. J.

MRS. ALBERT T. BECKETT, *President*,Salem
MRS. BLANTON C. WELSH, *Recording Secretary*,Montclair
MR. C. R. DIEFFENBACH,Jersey City
MRS. HARRIET FISHER ANDREW,Trenton
WELLS P. EAGLETON, M.D.,Newark

HON. WILLIAM FELLOWES MORGAN, resigned January, 1916; Wells P. Eagleton, M.D., appointed to succeed Mr. Morgan, in February, 1916.

MRS. HARRIET FISHER ANDREW, appointed member of Advisory Board of State Purchasing Commission.

MRS. ALBERT T. BECKETT, appointed Budget Officer in compliance with new Budget Act, passed in 1916.

GENERAL STAFF.

MISS ALICE IRENE WOOD, Temporary Executive Sec'y from August 7th, 1916
MISS J. M. SPRINGER,Bookkeeper
MISS LYDIA Y. HAYES,Supervisor to August 7th, 1916

HOME TEACHERS.

MISS ANNE V. WARD,Camden
MISS M. A. SPRINGER,East Orange
MR. WILLIAM J. ADICKES,Hoboken
MISS BERTHA M. JOHNSON,Bridgeton
MISS MARGARET HOGAN,Orange

TEACHER OF PIANO TUNING AND REPAIRING.

MR. WILLIAM B. SCHOTT,Irvington

FINANCIAL STATEMENT

November 1st, 1915, to October 31st, 1916.

RECEIPTS.

General expenses,	\$10,000 00
Preventive work,	750 00
Extension of home industries,	1,000 00
	\$11,750 00

DISBURSEMENTS.

General Expenses.

Salary of Supervisor, Nov. 1, 1915, to Aug. 7, 1916, date of termination of services,	\$922 58
Salary of Executive Secretary, from Aug. 7, 1916, date of temporary appointment, to Oct. 31, 1916,	181 45
Salary of Clerk (acting in capacity of guide and Private Secretary to Supervisor), Nov. 1, 1915, to Aug. 7, 1916, date of termination of services,	395 16
Salary of Clerk,	600 00
Salary of Home Teacher,	600 00
Salary of Home Teacher,	600 00
Salary of Home Teacher,	600 00
Salary of Home Teacher,	600 00
Salary of Home Teacher (salary increased \$5.00 per month May, 1916),	510 00
Salary of teacher of piano tuning,	153 00
Salary of Guide to Miss Anne V. Ward (Home Teacher),	199 50
Salary of Guide to Miss Bertha M. Johnson (Home Teacher),	199 75
Salary of Guide to Miss Mary A. Springer (Home Teacher),	169 75
Salary of Guide to Miss Margaret R. Hogan (Home Teacher),	210 50
Services of Guide to Supervisor,	85
Salary of janitress,	180 00
Extra clerical help,	54 25
Expressage,	145 60
Office furniture,	172 66
Office supplies,	89 81
Postage,	167 26
Stationery,	58 99
Telegraph,	7 87

NEW JERSEY COMMISSION FOR THE BLIND.

Telephone,	\$97 25
Transportation,	1,638 51
Maintenance,	864 72
Workshop supplies,	114 77
Books,	4 25
Sundries,	29 24
Gas,	22 23
Fire insurance,	16 77
Coal,	125 00
Water assessment,	13 54
Painting,	8 00
Masonry,	22 60
Plumbing,	42 84
Fees for demonstrators,	157 00
Assistance in preparation of materials for class and home work,	24 30
	<hr/> \$10,000 00

PREVENTIVE WORK.

Clerical work,	\$50 00
Expressage,	6 86
Postage,	56 24
Stationery,	16 00
Office supplies,	16 04
Telephone,	5 00
Transportation,	11 34
Maintenance,	1 75
Preventive pamphlets,	416 55
Charts,	98 50
Multigraphing,	25 82
Lantern slides,	45 90
	<hr/> 750 00

EXTENSION OF HOME INDUSTRIES.

Workshop supplies,	\$924 53
Stationery,	1 79
Telephone,	70
Transportation,	13 35
Maintenance,	16 88
Expressage and freightage,	4 20
Postage,	28
Books,	8 91
Sundries,	10 48
Cutting and preparing materials for home and class work,	18 88
	<hr/> 1,000 00
	<hr/> \$11,750 00

**APPROXIMATE STATISTICAL SURVEY OF BLIND, AS ON FILE
AT COMMISSION'S HEADQUARTERS
November 1st, 1915, to October 31st, 1916**

Number in State,	1,700
Investigated through Commission—	
Males,	900
Females,	800
Under 20,	190
Between 20 and 70,	1,060
Over 70 years,	450
Teachable blind,	600
Under 20,	90
Male,	47
Female,	43
Over 20,	510
Male,	250
Female,	260
Number of blind in educational institutions,	90
Of this number there are 24 in public schools.	
Number of blind suitably provided for in own homes,	1,200
Number of consignors at Headquarters,	105
Number of cocoa and chocolate agents,	96
Occupied blind,	830
Remuneratively,	340
Industrially,	170
Housework,	250
Chores,	70
	830
Number of blind dependent upon benevolent institutions,	100
Number of blind in custodial care (almshouses, prisons, asylums),	90
Deaths reported,	37

Report of Commission

Hon. James F. Fielder, Governor of New Jersey:

SIR—In compliance with the law creating the New Jersey Commission for the Blind, we have the honor to submit to Your Excellency the following report for the year ending October 31, 1916.

This Commission is charged with the important work of ameliorating the condition of the blind in New Jersey. Blindness requires no special advocate to make the general public realize its blighting influence, nor the great handicap it imposes as to education and occupation, both of which are essential to self-support.

The first organized effort of the Commission was the teaching of blind adults in their own homes. This work is largely humanitarian, and, although there is but little pecuniary return for efforts expended, we cannot emphasize too greatly the importance of this work; not only are the lives of the blind men and women brightened by the home teachers, themselves blind, but they regain confidence in themselves, learn to read by use of the tangible types, and are taught various handicrafts for the blind, products of which are marketed by the Commission without cost to the blind producer.

The Commission has held eleven regular and two special meetings during the year; two conferences with the five home teachers, and a conference with the representatives of the New Jersey State Federation of Associations of Workers for the Blind.

The Legislature of 1915 appropriated \$10,000 for the furtherance of the work of the Commission in general. Through the generous interest of the Legislature of 1916, supplementary appropriations of \$750 for preventive work and \$1,000 for extension of home industries and further employment of the blind were made.

A detailed summary of the expenditure of all appropriations granted is included in this report.

As a result of a limited survey of conditions in New Jersey, made by Mr. Gordon L. Berry, of New York, through the courtesy and generous co-operation of the National Committee for the Prevention of Blindness, of which he is Field Secretary, together with the tabulated statistics giving general causes of blindness in New Jersey, the Commission secured by legislative enactment extension of its powers to include Prevention of Blindness, and to adopt and enforce proper preventive measures.

Realizing the value of and necessity for effective co-operation in this work, and with a view to co-ordinate the efforts of the State Boards, the Commission held a conference with the State Board of Health, the State Board of Education and the Department of Labor, all of which are vitally interested in the subject matter of this act.

With the limited appropriation of \$750 the Commission inaugurated a publicity campaign for the Prevention of Blindness. This has been made effective by the co-operation of the various State Boards, Women's Clubs, National Committee for the Prevention of Blindness, State and County Medical Boards and other organizations interested in the Conservation of Vision. Since January, 1916, the State Board of Health has furnished to the Commission duplicate copies of all cases of Ophthalmia Neonatorum and Trachoma reported to them. Nothing short of eternal vigilance in following up these blighting diseases will suffice to lessen their ravages and prevent the needless blindness that they cause. A conservative estimate of the cost to the State for the education and care of a person blind from infancy is \$8,000; the loss to the State industrially cannot be estimated, while the loss to the individual is inconceivable; from an economic standpoint alone the State should grant the New Jersey Commission its full appropriation for the next year and a supplemental appropriation of \$2,500 for the work of Prevention of Blindness for the current year. In reporting that but one case of blindness has resulted from Ophthalmia Neonatorum in 1915 in Massachusetts that Commission for the Blind has *clearly*

demonstrated the fact that with *adequate* funds for the conduct of the work blindness from Ophthalmia Neonatorum *can be prevented*. Are not the children of New Jersey as great an asset to their commonwealth as the children of Massachusetts are to that State?

After seven years' work the Massachusetts Commission for the Blind has demonstrated (1) "that by educating the public and by *strict enforcement* of prophylactic measures a large percentage of eye disablement and blindness can be prevented; (2) that by vigorous co-operation among all the agencies concerned much of the defective vision due to incipient disease, to working under conditions of improper lighting, to overstrain, to lack of glasses and other like causes may be done away with." The Commission for New Jersey begs for the privilege of handling the problem with equal thoroughness, assured that happiness and increased efficiency for those so seriously handicapped must follow such efforts.

The scope of the work for the blind was further extended by a law enabling the Commission to give practical encouragement by loans of capital, of stock in trade, or of tools or apparatus for blind persons desirous of earning a living by industrial occupation or other form of business activity. This law should materially ameliorate the condition of the blind.

It is the purpose of the Commission to make its office a clearing house and bureau of information and employment for the blind of New Jersey. In every aspect of the work in which the Commission is engaged the fundamental importance of co-operation is manifested.

The State of New Jersey is in advance of other States in the provisions made for the education of the blind. The policy of the State is to board and educate such children and youths in institutions for the blind in New York City and Philadelphia, where they are given specific training. The State also provides higher education for the blind in any college, university, technical school or professional school within the State. Special classes for blind children in the public schools are now provided, where there are eight or more attending. This is largely experimental as yet, but the plan has been endorsed by many educators of the

blind. The State further provides for the scientific care and education of blind babies, committing such from babyhood up to eight years to the Arthur Home, at Summit, N. J., under the efficient management of the International Sunshine Society, Incorporated, in New Jersey. This institution has been approved by the various State departments of New Jersey, and has the endorsement of the Commissioner of Charities, who considers that the essentially important "work it is doing by taking the child at the very beginning of its helplessness and preparing it for the higher schools for the blind is to be highly commended." He further states that he has visited the Home, and that the general "management, cleanliness and equipment are highly satisfactory" to the Department of Charities and Corrections.

The education of the adult blind who have lost their sight by accident or disease at an age when the institutional training was not available is, in a measure, provided for through the Home Teaching Department of the Commission. The blind in homes, almshouses, prisons and asylums are reached through this medium.

The Light House at Trenton, managed by the Trenton Auxiliary for the Industrial Blind, incorporated in New Jersey, conducts a workshop for men, and provides a home where they can be properly cared for, as well as maintaining an exchange where the work of other blind people living in their own homes can be sold. The Light House, though not self-supporting, is sustained by contributions of generous-hearted people, and should widely appeal to all those who are interested in the successful welfare of the blind. St. Joseph's Home for the Blind, Pavonia Avenue, Jersey City, has increased its capacity for caring for the blind.

The Commission for the Blind realizes that the appropriation made for the current year is not commensurate with its extended scope of work and activities, and urges an increase for the furtherance of its work.

A material increase is necessary to carry on the work of Prevention of Blindness, as the services of a Field Secretary are absolutely essential for the proper conduct of this department.

The State of New Jersey should not be satisfied until every agency within its bounds, legislative, administrative, public and private, is working in full and intelligent co-operation to stamp out all causes of preventable blindness. This cannot be accomplished without adequate financial aid.

Statistics from the National Committee for the Prevention of Blindness show the following proportion of pupils blind from ophthalmia neonatorum in thirty-one schools for the blind in 1915-16:

<i>Total Pupils.</i>	<i>Blind from Ophthalmia Neonatorum.</i>	<i>Per Cent.</i>
3,501	760	21.7

Public schools in four large cities:

<i>Total Pupils Blind.</i>	<i>Blind from Ophthalmia Neonatorum.</i>	<i>Per Cent.</i>
357	83	23.2

The astounding fact is that these 843 children are needlessly blind for life; their blindness could have been prevented. Does prevention of blindness pay?

The Commission recommends:

1. An increased appropriation for the higher education of the blind.

2. That medical inspection in public schools be extended to include an ophthalmologist's examination of all school children with seriously defective eyesight, and that in all institutions for children and adults, whether or not under State control or containing wards of the State, regular visits for examination and treatment be made by an ophthalmologist, as a member of the institution's staff. Errors in diagnosis can be avoided and even blindness prevented.

3. Adequate provision through existing institutions for the care and education of the feeble-minded blind.

4. Extension of present curriculum in public schools, so as to include special training in physical culture, in gymnasium, and lessons in swimming pool, music and extended instruction in typewriting and use of dictaphone.

To enumerate the agencies and individuals that are assisting in the work for the blind would require much space, but to all

legislators, officials, various State departments and local boards, to individuals and organizations, public, private, philanthropic, to physicians, churches and social workers the Commission extends its gratitude and asks a continuation of the support and co-operation extended. To our own workers, past and present, sighted and sightless, we hereby express our hearty appreciation of the devoted and unselfish service to the State and the blind within it.

Respectfully submitted,

MRS. ALBERT T. BECKETT,
President.

Executive Secretary's Report

To the New Jersey Commission for the Blind:

In the presentation of my report to your Commission it is very gratifying to note the ability of the Home Teaching personnel to cope with the increased quota of work undertaken in the further instruction of the blind throughout the State.

The total number of pupils reported as benefited by scholastic and industrial instruction in their own homes and at headquarters is 275, receiving through the course of the year 3,756 lessons. The total mileage covered by the staff of blind-teachers is 35,000. Unfortunately, the prevalence of the epidemic of poliomyelitis compelled the omission of two weeks in July by two of the force, and of the regular teaching month of September by all. A conference with the home teachers was held on September 26th, at which salesmanship as a vocation for the blind and some of the methods of meeting with home teaching problems were freely discussed.

Miss Anne V. Ward has been appointed on the Uniform Type Committee, a tribute much appreciated by our Commission. The unqualified devotion and loyalty of the six teachers in the studied capabilities and aptitudes of each pupil in hand have been productive of the best results, and such as have attested to the developed efficiency of this splendid corps of workers.

Two of the teachers were particularly fortunate in having the opportunity presented for a course of instruction in a Normal Training Class at the Headquarters of the Blind, Brooklyn Bureau of Charities, which has given an added stimulus to the introduction of new industries at headquarters, the equipment for which could more properly and appreciably be enlarged through an increased State appropriation devoted to such a purpose. The financial relief of the blind can best be served through the adoption of a sound economic policy which has for its object the rendering of such aid to the blind as will most effectively add to their independence and self-support. In addition to crocheting, knitting, sewing and basketry, three classes a week are now operating in three new forms of industries, weaving, willow and brush work, turning out products the artistic and practical merits of which are proving of commercial value. An appropriation of \$1,500 as a Revolving Industrial Fund, from which loans of stock in trade and apparatus are made to the blind as an aid to some form of productive activity, was made possible by legislative enactment.

A standard of quality and excellence with regard to each consigned article is maintained in every possible instance, in the full belief that the highest value and best returns to the blind will the better be yielded by their constant adherence to, and understanding of, the thorough business-like and systematic basis on which they are expected to make consignments.

The service of an auto bus has been secured to convey the blind to and from headquarters, assuring the regularity of attendance upon classes

in session. Another class in Jersey City has been very successfully started by one of the teachers.

The Commission was also fortunate recipient of the generosity of Mrs. Fuld, of Newark, in the matter of the extended use of her car until the spring of 1916. Co-operation on the part of local department stores, lunch-rooms, and other places of business has been sought with a view to securing chair-caning orders. The expense of the cartage of chairs to and from their destination is being borne, to a certain extent, by the chair owners themselves. The results attained in this department of work are indicated by the fact that 565 chairs were caned this last year by ten caners, who received \$481.00.

The articles consigned by the blind have been disposed of through sales and demonstrations, 21 of which have been held during the year. The work of the blind was demonstrated and placed on sale at the Newark Anniversary Industrial Exhibit from May 13th through June 3d, the generosity of the general management in the donation of free space and admission to the exhibit being greatly appreciated. The co-operation of the Camden Association of Workers for the Blind is further acknowledged in the successful results of a sale at the Industrial Exhibit in their city, also the courtesy of all the churches, organizations and individuals that have freely given of their time and effort to augment the sale of goods.

As a result of sales, \$1,650.00 has been paid directly to the blind for work. Splendid wholesale prices have been secured in the purchase of materials, and the policy of furnishing the blind with goods at the lowest possible cost encourages business enterprise; this advantage of negotiating for materials is well regarded in their behalf. It is the purpose of the Commission to standardize the products of the blind, and thus be assured of a market. A list of articles made by the blind is now being prepared for publication.

Mr. U. B. Brewer has supplied the blind with cocoa and chocolate products at wholesale price, from the sale of which \$1,260.00 in actual profits have been derived. His continued interest is very much appreciated by the Commission and the blind of our State.

Dyeing of all materials for the various forms of industrial work, such as silk, mercerized warp and filling, unbleached muslin, raffia and reed, has been successfully undertaken, and the Commission will continue to supply materials for this department of the work.

Two maps are in use at the Commission rooms, on which the routes of the teachers and the localities of the blind of the State have been traced. Catalogues and reports relating to or bearing upon the work are kept on file.

The library at headquarters, consisting of about 125 volumes, has been catalogued and copies of a classified list prepared for ready reference. The supply of books on hand, however, is supplemented by the Newark, Philadelphia and New York Libraries, which at all times have made very generous response to the requests for reading matter. In addition, numerous magazines have been subscribed for and freely made use of by all blind persons desiring to borrow them.

It is a pleasure to report that our schools and Boards of Education, through special attention called to the matter, are beginning to recognize

the fact that the blind can satisfactorily fill contracts for tuning. A list of piano tuners is now maintained at headquarters, and it is urgently hoped the public will give the preference for such orders to the blind, who can demonstrate, by a given opportunity, their competency to undertake this work. This is regarded as the most remunerative occupation engaged in by the blind. Our tuning class, under the instruction of a competent teacher, and through the stimulus of the co-operation of School Boards in the matter of tuning orders, is proving beneficial to the men desiring to enter this field of the work.

Assured that where real enterprise exists and opportunities are not too greatly circumscribed, the Commission has sought to stimulate and encourage salesmanship by securing agencies in which the individual might be interested. The capabilities of the blind are just as carefully studied from a scholastic, cultural and vocational point of view as those of the sighted, and wise direction and encouragement in the pursuit of an adaptable occupation is given those who desire to compete with the sighted in any sort of business proposition. A splendid opportunity has been offered any blind man wishing to avail himself of a course on salesmanship, through the courtesy of Mr. Townsend, Educational Director of the Young Men's Christian Association of Newark. One of our men who secured an agency for selling coal recently not only proved his ability to obtain orders by selling eighty-two tons within the first few weeks, but was adjudged by his employer as the best agent he had ever engaged. New Jersey continues to believe in the individual potentialities for self-dependence of its blind, and with the proffered spirit of true helpfulness on the part of the public, many of the obstacles and difficulties now facing the blind will be removed.

Social use is made of the rooms at headquarters, where the blind enjoy musical and other recreations contributed by them and their friends. Through the generosity of Mr. Franklin Conklin, a number of the blind enjoyed Thanksgiving and Christmas dinners; a Christmas tree was provided at headquarters for the children of the Newark Class for the Blind by another generous friend. To Mr. Franklin Conklin grateful thanks are also due for the use of the building occupied by the Commission the past year. Acknowledgment is made of the invitation of the Oratorio Society to the Messiah in Newark, and to the Young Men's Christian Association for their kindness in providing tickets to Asbury Park in July and August. All other courtesies in the matter of the conduct of sales, preparation of materials for industrial work, and other contributions, are acknowledged with sincere appreciation.

The Commission, realizing the fundamental need of, and persistence in, the furtherance of a State-wide publicity campaign in the work of the prevention of blindness, has secured the co-ordinated efforts of the State Boards of Health, Labor and Education, Women's Clubs, and other bodies manifesting any degree of interest in this vitally important phase of the Commission's work. During the past year over 50,000 pamphlets have been purchased from the National Committee for the Prevention of Blindness, and 8,000 in seven languages, from the Illinois Society for the Prevention of Blindness, for gratuitous distribution at sales, and through these departments and organizations 10,000 or more pamphlets have been distributed. The Na-

tional Committee has rendered invaluable assistance in making the Commission's extended efforts possible. Under the auspices of the Commission a very appreciable number of lectures have been given throughout the State. One hundred and thirty-eight lantern slides have been purchased for lectures illustrating the visual harm which follows in the wake of ignorance and neglect of the knowledge of causes and means of prevention of blindness. Ophthalmia Neonatorum, Midwife, Industrial Accident, Wood Alcohol and Trachoma exhibits, consisting of five panels each, have been purchased from the National Committee and have been loaned to the Child Welfare Exhibit in Trenton and elsewhere, and it is planned to display these unique charts, in which a manifest interest has been taken, in public libraries where such permission may be obtained. The matter of the use of envelopes with partially opaque inserts, which have a possible deleterious effect upon the eyesight of letter carriers, is one worthy of our consideration.

In order to secure data regarding the recognition of State provisions as related to medical examinations in schools, and the reporting of cases of ophthalmia neonatorum and trachoma, circular letters have been addressed to over 500 local Boards of Health, medical societies, and the same number of principals, medical inspectors and superintendents of schools throughout the State, following up all such reported cases, ascertaining just what localities would be benefited by lectures and securing the enforcement of laws and provisions pertaining to this phase of the work. The statistics received from these sources present actual existing conditions, and upon such the Commission will base its efforts for the further prevention of blindness. At a conference held on June 21st with the State Boards, each department, in presenting its survey of present conditions, expressed interest and willingness to further the necessary constructive work in hand. Industrial accidents resulting in blindness in one or both eyes are reported directly to the Department of Labor, and statistics are furnished monthly in cases of ophthalmia neonatorum and trachoma. During the year 53 cases of trachoma and 44 of ophthalmia neonatorum have been brought to the attention of the Commission through the State Department of Health. These cases are followed up by the Commission in so far as possible with its limited appropriation. One hundred and twenty-two towns report 234,000 school children inspected 1915-1916, of which number 20,000 are indicated as in need of eye treatment. Surely these statistics alone point to a situation wherein even a rudimentary knowledge of the conservation of vision on the part of school pupils would prove not only of incalculable benefit to the individual affected, but to schools and State authorities which are interested in the future welfare of these children. Sustained co-operation should result in the support and initiation of legislation which will adequately provide for more rigid oversight of conditions and add to the financial strength of the Commission's endeavors and united activities in the eventual elimination of many of the causes of blindness in our State.

With the increased scope of preventive work and the labor contingent upon the close follow-up of all cases in hand, and the accurate maintenance of the records of the blind, the services of a field worker would prove of inestimable value.

The compilation of statistics received in the matter of the conservation of vision in schools points to the necessity of securing clinical facilities for the treatment of needy children whose opportunities for receiving charitable attention are practically nil.

The field of endeavor for the workers of the blind in the State of New Jersey is a wonderfully exhilarating one, replete with still greater possibilities for lasting good, and in proportion as we secure the co-ordinated and whole-souled efforts of all, just so will our activities prove indispensable in the great humanitarian interests at heart, and our full measure of success be assured.

Respectfully submitted,

ALICE IRENE WOOD,
Executive Secretary.

Document No. 44

Fifteenth Annual Report
OF THE
BOARD OF PHARMACY
OF THE
STATE OF NEW JERSEY

October 31st, 1916

Fifteenth Annual Report

of the

BOARD OF PHARMACY

of the

State of New Jersey

OCTOBER 31st

1916

TRENTON, N. J.
MACCRELLISH & QUIGLEY CO., STATE PRINTERS.

1916

Members of the Board of Pharmacy of the State of New Jersey.

LEWIS W. BROWN,Englewood, 1917
FERDINAND A. BONGARTZ,Jersey City, 1918
WILLIAM H. McNEILL,Paterson, 1919
GEORGE M. BERINGER, JR.,Camden, 1920
EDGAR R. SPARKS,Burlington, 1921

OFFICERS.

GEORGE M. BERINGER, JR.,*President*
LEWIS W. BROWN,*Treasurer*
EDGAR R. SPARKS,*Secretary*

EXAMINERS.

FERDINAND A. BONGARTZ,*Pharmacy*
GEORGE M. BERINGER, JR.,*Materia Medica*
WILLIAM H. McNEILL,*Toxicology*
LEWIS W. BROWN,*Chemistry*

AUDITING COMMITTEE.

FERDINAND A. BONGARTZ,Jersey City
WILLIAM H. McNEILL,Paterson
October 31st, 1916.

Letter of Transmittal.

Hon. James F. Fielder, Governor of New Jersey:

SIR—I have the honor to submit to you herewith the fifteenth annual report of the Board of Pharmacy of the State of New Jersey.

Respectfully,
EDGAR R. SPARKS,
Secretary.

Report.

Since the last annual report of the State Board of Pharmacy, there have been held the usual number of meetings for the examination of candidates, and the executive sessions. The Board has had a great number of complaints of alleged violations of the law during the year, all of which have been investigated, either by some member making a personal visit or by correspondence. A number have been, as usual, from some other cause than a desire to see that the law is complied with, but to get what is termed "even" with some other person, such as a clerk leaving an employer and the same day reporting to the Board that such an employer was violating the law by not having a registered person in charge of the pharmacy, when, as a matter of fact, perhaps the employer might have a registered clerk the next day, however, when complaint is received and the person has had the usual notice to comply with the requirement and persists in the violation, then evidence is obtained and the person prosecuted.

Complaint was received from Spring Lake regarding an alleged violation. The Secretary wrote to the person, and, after a full explanation had been made, the case was adjusted satisfactorily. Complaint was reported of a violation of the law by a firm of grocers at Roselle Park, selling a line of drugs and medicines. The Secretary wrote them, and, as no reply was received, Mr. Strauss was instructed to visit Roselle Park, and report. Mr. Strauss visited the firm, and, after making a full explanation of the law, they promised to comply. Action was suspended for the time. Complaint against stores in Morristown and Stirling was received, and Mr. Brown was instructed to investigate. He reported that both cases had been adjusted satisfactorily. The Secretary reported that a complaint had been received from Hackensack of a person who was conducting a pharmacy not being registered. The Secretary was instructed to write and inform the person that he must place his store in charge of a registered pharmacist at all times, and report to the Board the name of such pharmacist. The Secretary reported that the man had replied to the correspondence, saying his store was in charge of a registered pharmacist, and had given his name. At a later meeting of the Board, the Secretary reported that while this information was true on the day the letter was written, no registered pharmacist had been employed at any time since. The inspectors were directed to visit this store and secure evidence, which was done and prosecution ordered. Complaint against a person at Pompton Lakes was adjusted by correspondence, the store being placed in charge of a registered pharmacist. A complaint against a pharmacist at Lake Hopatcong was adjusted by correspondence, and a registered pharmacist placed in charge at all times. Also a complaint against a person in Paterson was adjusted in like manner.

Complaint was received against one store in Paterson and two in Hackensack. The owners not responding to the notice mailed them, inspectors were directed to secure evidence. Complaint against one store alleged that it was owned and conducted by a registered assistant. The Secretary was instructed to write him to place the store in charge of a registered pharmacist. While

it is a fact that a registered assistant, or even a person not registered, could own a store, it must be conducted by and in charge of a registered pharmacist at all times. The requirements of the law were complied with; but, only a short time afterward, a complaint was received against the same person. Inspectors were again directed to secure evidence, but in the meantime the store had been closed. Complaint was received against a registered assistant at Springfield who owned and conducted a pharmacy. The Secretary was instructed to write and inform him, which was done, and the store was at once placed in charge of a registered pharmacist.

Complaint against a store in Phillipsburg, being owned and conducted by a registered assistant, was adjusted by correspondence, and the store placed in charge of a registered pharmacist. Complaint against a firm at Haskell was referred to Mr. Strauss to investigate. He reported that the department of the store had been placed in charge of a registered pharmacist. Complaint that a pharmacist, who was registered and conducted a pharmacy at Cliffside, but left his pharmacy in charge of persons, who were not registered for days at a time, was investigated, and it was found that the complaint could not be sustained. Complaint that a pharmacist at Harrison was not registered and did not have anyone in his employ registered, was investigated by Mr. Strauss, and it was found that, temporarily, this had been a fact, but that a registered pharmacist had been employed, and would be again, which was attended to within a few days, and the owner became a registered pharmacist.

Complaint was received against a firm of general storekeepers at Ramsey selling a line of drugs and medicines. In correspondence the Secretary received a list of articles on sale, and marked off the ones that it would be a violation of law to sell, as the law permits the sale of non-poisonous, patent or proprietary medicines. The firm showed a desire to comply with the requirements of the law. Later this firm was reported again, and the entire case was referred to Mr. Strauss to investigate and report. This case is now under advisement. Complaint was received from Paterson of a registered assistant owner con-

ducting a pharmacy. This was investigated by Mr. Brown and reported as being satisfactorily adjusted, the owner having in his employ a registered pharmacist. Complaint was received that a person at Paterson, not registered, was selling drugs and medicines and conducting the store. The Secretary investigated this case by correspondence, reported the store was formerly owned by a pharmacist who had left the city, and the person being complained of was the owner of the building and had seized the stock, and did keep the store open, but all the time had a registered pharmacist in charge; had sold the stock, and it had been removed.

At a meeting of the Board in October, 1915, President Strauss stated that it had been reported to him that certain persons had advertised under the name of "The Hudson Pharmacy Institute," 272 Washington St., Jersey City, "A three months' course in Pharmacy, no counts required for admission, Certificate on graduation, State Board Guaranteed." President Strauss investigated a report that certain persons were conducting the institute and that one of the said persons had offered for a sum of money to guarantee certain students that they would pass the examination of the State Board of Pharmacy of New Jersey. This person, according to these students, stated that they had very little instructions, but were relying on the statement of one of the said persons that if they paid a sum of money they would secure the certificate from the Board. After a discussion by the Board, President Strauss was instructed to consult the Attorney-General. Later President Strauss reported that he had consulted the Attorney-General, and it was decided that it was a case for civil action to be brought by the persons who had paid the money and not by the Board of Pharmacy. Action was commenced by the students who paid the money, and the accused placed under bail of \$3,500, and the case submitted to the Hudson County Grand Jury, but no indictment was found.

The following cases have been prosecuted:

June 30th, 1914. Evidence was secured against Louis M. Lucia, not registered, violation permitting clerk not registered to sell drugs and medicines. This case was adjourned from time to time; did not come to trial

until March 31st, 1915. Trial was held in District Court at East Rutherford before the Judge. Defendant did not appear. Judgment was given in favor of the Board, execution entered. The Board was afterward informed that the Judge and the clerk of the court had become confused as to the date set for trial, and did not discover this confusion until after the judgment had been entered. On that date the Judge, on motion, granted a rule to show cause why the judgment should not be set aside. Under the circumstances the Attorney-General consented, and the case set for trial June 23d adjourned to September 8th, to September 15th, to October 13th, to October 27th, to November 17th, and, finally, on January 12th, 1916, the retrial was held in the same court. Defendant was represented by counsel; no jury. After an hour's trial the case was decided by the Judge in favor of the Board, and the full penalty and costs imposed.

November 27th, 1914. Evidence was secured against John H. MacLennan, of Gloucester City. Violation, selling drugs and medicines, not being registered, nor any one in his employ registered. Trial was set for December 24th, 1914, but was adjourned to December 29th, adjourned to January 28th, 1915, adjourned to February 25th, adjourned to December 2d. Trial was held in Camden District Court, before a jury of twelve men, trial lasting six hours. Jury rendered a verdict in favor of the defendant.

July 13th, 1915. Evidence was secured against Frederick Zeller, of Plainfield. Violation selling drugs and medicines at retail, not registered. Trial held in District Court of Elizabeth, on December 6th, 1915. Defendant did not appear. Judge rendered decision in favor of the Board, penalty and costs.

July 16th, 1915. Evidence was secured against Jack Rubin, Keansburg. Violation, selling drugs and medicines at retail, not registered. Trial was set for October 21st, in District Court of Monmouth County, Asbury Park; adjourned to November 12th. Defendant was not present, nor was he represented by counsel. Judge rendered a decision in favor of the Board, with penalty and costs.

November 24th, 1915. Evidence was secured against Joseph B. Grossman, of Newark. Violation, permitting an unregistered clerk to sell drugs at retail. Trial was set for February 10th, 1916, but was adjourned until a later date. Case tried on October 6th, 1916, in the First District Court of Newark. Defendant declared guilty. Judge imposed penalty and costs.

July 8th, 1916. Evidence was secured against Peter Zalewski, of Passaic. Violation, permitting an unregistered clerk to sell drugs at retail. Case tried on October 11th, 1916, before a jury in the District Court of Passaic. A verdict of guilty was rendered by the jury.

July 26th, 1916. Evidence was secured against William Clarence Jones, of Tuckerton. Violation, conducting a pharmacy without being registered. Trial was set for October 27th, 1916, at Toms River, but was adjourned, at the request of defendant's counsel, until a later date.

July 26th, 1916. Evidence was secured against Spragg and Anderson, proprietors of a general merchandise store, in Tuckerton. Violation, selling drugs at retail, not being registered. Trial set for November 24th, 1916.

July 26th, 1916. Evidence was secured against John W. Horner, proprietor of a general merchandise store in Tuckerton. Violation, selling drugs at retail, not being registered. Trial set for November 24th, 1916.

The death of David Strauss, the former president of this board, which occurred in August last, deprived the State of the services of a faithful official, and the sudden ending of his active career is recorded with regret. Mr. William H. McNeill, of Paterson, was appointed as his successor. The board was reorganized as follows: Mr. George M. Beringer, Jr., was elected President (succeeding Mr. Strauss), and Mr. Ferdinand A. Bongartz was elected examiner in the subject of Pharmacy, while Mr. McNeill was elected examiner in Toxicology.

In August last this board affiliated with the National Association of Boards of Pharmacy as an associate member, the same class of membership held in this National Organization by our neighboring States of New York and Pennsylvania. This affiliation brings this board into fellowship with about forty sister States, and we believe that such association will be of decided benefit in our work.

The date for the triennial re-registration of all pharmacists holding certificates issued by this board has been fixed for January 1st, 1917. According to a ruling recently adopted, the board will request the registration of every pharmaceutical apprentice in this State, and a notice to that effect will be sent to every pharmacist and assistant, with his or her notice of re-registration. No fee will be charged for the registration of apprentices.

The suspicion has long been held by this board that false affidavits, executed outside this State, have been submitted, and recently this has been verified in at least two cases. Our thanks are due Mr. Warren L. Bradt, the efficient Secretary of the New York Board of Pharmacy, for his earnest co-operation in this matter. Mr. Bradt appeared with official records of registration on October 19th, 1916, at Trenton, N. J., at a hearing granted to a candidate who was accused of presenting a false affidavit to this board, and the falsity of both the said affidavit and of the testimony given at the hearing by the suspected candidate was shown when the official records were presented. This experience led to the adoption of a rule that candidates submitting affidavits of apprenticeship served in other States "must have complied with all regulations and laws as to registration of

service in such States before such experience will be accepted for credit by this board," and said evidence must be approved by the Secretary of the Board of Pharmacy of that State.

At various times the charge has been made that candidates have been impersonated at our examinations. This charge was found to be true at our examination on October 20th, 1916, when a candidate was summoned aside and questioned concerning his real identity. Under cross-examination, the suspected man soon admitted that he was impersonating another candidate, and had been induced to appear at the examination for such other candidate by a person outside this State. The impersonator was brought before Assistant Attorney-General Theodore Backes, Esquire, where he signed a deposition setting forth the facts above reported. Further punishment was not imposed upon this man at the time, as the board has reason to believe that other persons are implicated in the scheme of endeavoring to obtain registration by fraudulent means. Because of the desire to locate the guilty parties, the names of those directly concerned are withheld from this report. Further investigations are now in progress.

After due consideration the following "Prerequisite Resolution" was recently adopted as one of the rules of this board:

WHEREAS, The Board of Pharmacy is directed by Section 3 of the Pharmacy Law to examine candidates for registration in the subjects of Materia Medica, Pharmacy, Chemistry and Toxicology, and to grant certificates to such persons, as it may judge, upon the basis of said examinations, to be properly qualified to practice Pharmacy; and

WHEREAS, It has been found by the Board that candidates, who have not had instruction in a School of Pharmacy upon these subjects and sciences, fail to pass satisfactory examinations in said subjects and therefore cannot be considered to be properly qualified; and

WHEREAS, The Board is empowered, by the aforementioned Act to make by-laws and rules for the proper fulfillment of its duties; therefore, be it

Resolved, That every person applying for registration as a Pharmacist on and after July 1st, 1918, must present a certificate of graduation from an approved School of Pharmacy, giving not less than a two (2) year course before graduation; and be it further

Resolved, That a School of Pharmacy, in order to be approved by this Board, must have, in the judgment of the Board, proper facilities and equipment for instruction in laboratory and classroom in the above-mentioned branches and must require that the students shall have at least one (1) year

of High School instruction, or its equivalent, before entering upon the course in Pharmacy.

Experience has demonstrated the need of certain changes in our Pharmacy Law, and we therefore respectfully suggest that the following recommendations receive earnest consideration, and further ask that they be submitted to the next Legislature with the urgent request that the same be given favorable consideration :

Recommendation No. 1. That the President of this Board be empowered to issue subpoenas and to administer oaths in the taking of testimony in all matters pertaining to the duties and regulations of this Board. (The need for this has been shown in recent hearings before the Board.)

Recommendation No. 2. That this Board be given power to refuse an applicant for examination and to revoke the certificate of a Registered Pharmacist or a Registered Assistant Pharmacist upon giving notice in writing and after a hearing thereon for any of the following reasons :

First, when the applicant is not of good moral character;

Second, when the registration is shown to have been obtained by misrepresentation or by fraudulent means;

Third, when the applicant for, or the holder of, the certificate is shown to be addicted to the use of narcotics, drugs or of stimulants to such an extent as to unfit the applicant for, or the holder of, the certificates for the proper performance at all times of the duties of a Pharmacist or Assistant Pharmacist;

Fourth, when the applicant for, or the holder of, the certificate has been convicted twice of a violation of that law, which is commonly known as the "Anti-Narcotic Act," or the holder of the certificate has been found guilty of continuous and wilful violations of this or any other statute relating to the practice of Pharmacy.

Recommendation No. 3. That this Board be empowered to accept the certificates issued by the Boards of Pharmacy of other States in lieu of examinations, if such other States shall have an equivalent standard for registration, and provided, also, that the said Boards of Pharmacy of such other States shall grant Pharmacists and Assistant Pharmacists registered in accordance with the Pharmacy Law of this State the same privilege to practice in such other States; such reciprocal recognition of certificates to be subject to such rules and regulations as may from time to time be made by the Board of Pharmacy of this State.

Recommendation No. 4. That each applicant for a Registered Pharmacist's certificate shall, in addition to possessing the qualifications specified in the present Pharmacy Act, be required to present credentials showing that he or she is a graduate of a School of Pharmacy which is approved by this Board.

Recommendation No. 5. That the owner of every pharmacy in this State shall be required to display conspicuously on the exterior of the store or on the window or door thereof the name of the proprietor thereof and the

name of the registered person in charge. (This is very necessary in order that the Board may fix responsibility in prosecuting.)

Recommendation No. 6. That this Board be empowered to publish its annual report and to mail a copy thereof to each Registered Pharmacist and Assistant Pharmacist of this State. (The object of this is to secure the moral support of the pharmacists of the State in the enforcement of the law.)

The following is the record of the examinations for Registered and Assistant Pharmacists conducted during the present year:

		<i>Examined.</i>	<i>Passed.</i>
Jan. 20.	Registered Pharmacist,	127	40
Jan. 21.	Registered Assistant,	21	7
April 20.	Registered Pharmacist,	196	62
April 21.	Registered Assistant,	30	11
July 20.	Registered Pharmacist,	140	47
July 21.	Registered Assistant,	22	9
Oct. 19.	Registered Pharmacist,	153	18
Oct 20.	Registered Assistant,	16	4
Total,		705	198

. There are on record at the present time:

Registered Pharmacists,	3,209
Registered Assistants,	179

Total number Registered persons,	3,388
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Respectfully submitted,

EDGAR R. SPARKS,

Secretary.

Rules of the Board (Revised October, 1916).

The Board of Pharmacy meets on the third Thursday of January, April, July and October, in Trenton, at the State Capitol, at 10 o'clock A. M.

According to law, two grades are established, Registered Pharmacist and Registered Assistant, and different examinations are held for each grade. Applicants for "Registered Pharmacist" certificates shall not be less than twenty-one years of age, and shall furnish affidavit from employer as to time of service, covering at least four years, and shall also furnish written evidence from employer as to character, and shall pay to the Secretary of the Board of Pharmacy a fee of ten dollars. Applicants for "Registered Assistant Pharmacist" certificates shall not be less than eighteen years of age, and shall furnish affidavit from employer as to time of service covering at least three years, and shall also furnish written evidence from employer as to character, and shall pay to the Secretary of the Board of Pharmacy a fee of five dollars.

All applicants for examination presenting certificates of time (pharmaceutical apprenticeship) served in other States, *must have complied with all regulations and laws as to registration in such States*, before such time will be accepted for credit by this Board. Such evidence of apprenticeship must be approved by the Secretary of "The Board of Pharmacy" of that State in which said apprenticeship was served.

In case of failure to pass a satisfactory examination, the applicant will be granted a second examination (without payment of another fee) within one year from the first examination. Applications must be on file with the Secretary ten days before the examination.

The examinations include the subjects of Materia Medica, Pharmacy, Chemistry and Toxicology, and an average of seventy-five per cent. (75%) is required for passing. Six hours will be given in which to answer the questions.

Every person applying for registration as a Pharmacist under this Act on and after July 1st, 1918, must present a certificate of graduation from an approved School of Pharmacy, giving not less than a two (2) year course before graduation.

A School of Pharmacy, in order to be approved by this Board, must have in the judgment of the Board, proper facilities and equipment for instruction in laboratory and classroom in the above-mentioned branches and must require that the students shall have at least one year of High School instruction, or its equivalent before entering upon the course in Pharmacy.

A triennial re-registration of Registered and Assistant Pharmacists is required; the fee is fifty (50) cents, for which a renewal of the original registration is issued; the time of such renewal is fixed by the Board.

The purpose of this re-registration is to keep a complete record of the Pharmacists and to be assured that the law is being obeyed.

The registration of every pharmaceutical apprentice in this State is now required and a notice to this effect will be sent to each Registered Pharmacist with his or her notice of renewal of registration.

Further particulars and application blanks will be furnished upon application to the Secretary.

By order of The Board of Pharmacy of the State of New Jersey.

Burlington, N. J.

E. R. SPARKS,
Secretary.

Document No. 45

R E P O R T

OF THE

**New Jersey State Board of
Children's Guardians**

For the Year 1916

REPORT

OF THE

New Jersey State Board of Children's Guardians

FOR THE YEAR
1916

TRENTON, N. J.
MACCRELLISH & QUIGLEY Co., State Printers

1917

NEW JERSEY STATE BOARD OF CHILDREN'S GUARDIANS, 1916.

CAROLINE B. WITTPENN, *President*, Jersey City, N. J.
BENJAMIN F. EDSALL, *Secretary*, Newark, N. J.
ROBERT L. FLEMMING, *Treasurer*, Jersey City, N. J.
JOSEPH MCCRYSTAL, Paterson, N. J.
MRS. F. C. JACOBSON, Newark, N. J.
JAMES A. BURNS, East Orange, N. J.
CHARLES J. FISK, Plainfield, N. J.

EXECUTIVE COMMITTEE.

MRS. F. C. JACOBSON, <i>Chairman</i> ,	MRS. CAROLINE B. WITTPENN,
ROBERT L. FLEMMING,	JOSEPH MCCRYSTAL.

FRANCES DAY, *General Agent*,
Commercial Trust Building, Jersey City, New Jersey.
Telephone, 261 Jersey.

Report of the President.

Hon. James F. Fielder, Governor of New Jersey:

SIR—Our report of the year's work of the New Jersey State Board of Children's Guardians naturally divides itself into the departments for the care of dependent children and of the widows and children under an "Act for Promoting Home Life for Children."

The first division of our work has been established so long that it does not present any new or startling problems, and some of those which are confronting us we share in common with the rest of the nation. The increased cost of all the necessities of life has made it impossible for our very best homes to continue to care for the children for \$1.50 a week. This price has never been changed since the beginning of the Board's work, eighteen years ago. Our Board felt that the demand for an increase was justified, and we have decided to raise our payment to \$2.00 a week for each child. Although we regret the increased cost to the counties, we know that none of those concerned would wish to have the children's health suffer or the high standard which we maintain for our homes reduced.

We realize that many of those interested in child welfare in the State feel that no child should be committed to the almshouse. Theoretically, this would undoubtedly be an ideal condition, but as a matter of practical administration much can be said on the other side. In the first place, the majority of children coming to us do so in company with their mother, who for a variety of reasons has herself been committed to the almshouse. Many of our children are born in the almshouse. In all these cases some place to shelter the mother would have to be provided, and would necessarily be open to the same amount of stigma as now attaches to the almshouse.

6 STATE BOARD OF CHILDREN'S GUARDIANS.

In the case of foundlings, abandoned children, etc., some temporary home must be found. In dealing with all these cases our policy is to place mothers and children outside the almshouse wherever it is possible. In the counties where there are Children's Homes, or where we can use hospitals or private institutions, we invariably do so. In the counties where there are no private institutions of this kind it seems unavoidable that the almshouse should be used. There must be a temporary abiding place for the child before it is placed in a private family for a period long enough to allow its relatives to be traced in order to prevent unnecessary or unfair burdens being placed on the counties. In cases where the child is found to be a proper charge there must be time sufficient to have its eyes, throat, nose, ears, teeth, etc., examined and cared for before it is permanently placed. We must also allow time to cover the period of incubation for contagious diseases.

Once more we can emphasize the encouragement of our work which comes from the increasing number of boys and girls now in homes of their own, self-supporting and valuable to the State. We claim this happy result, first, from our system of placing out versus the institution; secondly, from the personal and helpful influence of our agents and of the splendid men and women who have assumed the immediate care of the children.

In the Widows' Pension Department we can report decided progress. The number of petitions is gradually but surely being reduced, so that now we have only 434 petitions awaiting hearing. In a short time we feel that we can promise that all petitions will be attended to in a short time after they have been filed. This is all the more satisfactory because we have not departed from the policy which we adopted three and a half years ago of giving each and every petition the time sufficient for a thorough and complete investigation. This policy has continued to justify itself because we can now feel that the widows placed on the pension list have the right to be there. Whenever any information comes to us which leads us to feel that this is no longer true the same kind of investigation is made once more, so that the judge may be able to intelligently decide whether the pension should be continued or revoked.

We have gathered some statistics, making an interesting comparison between one hundred cases in the country and in the city. The number of cases recorded is, of course, too small to draw any decided conclusions from them, but they certainly indicate that there is not so much difference as might be supposed between the conditions surrounding the city and the country families.

As our work in this department continues and grows our Board is becoming more and more convinced of the potential possibilities for achieving real and valuable results, but the further we get in the work the clearer becomes our realization that this value will be achieved in proportion to the strength of the contact which we can have with the families under our care, and that this contact must be limited by the number of agents employed. Until now our work has been handicapped because the agents at our disposal will not even permit us to carry out the provisions of the law in visiting the children six times a year. We shall continue to plead for an increase in our force, and the strength of our plea is our belief that the value of our work is not restricted to the cash distributed, but rather to the advice, sympathy, understanding and admonitions of our agents. Once more the human and spiritual element of any relief work asserts itself as preëminent.

CAROLINE BAYARD WITTPENN,
President.

Report of the General Agent.

To the New Jersey State Board of Children's Guardians:

I respectfully submit herewith my annual report for the year ending October 31, 1916.

The latter part of the year just closed has been very trying to every one engaged in child-caring work, because of the recent epidemic of infantile paralysis.

Owing to the strict quarantine throughout the State, it was very difficult to transfer children anywhere, so that most of our work from July to October was done under great strain.

Hudson County Almshouse, where there were a number of defective children, was placed in quarantine in order to protect these children from outside contagion.

The dental work, operations on children for the removal of adenoids and enlarged tonsils, as well as other minor operations, were suspended, owing to the hospitals discontinuing this work during the epidemic. Therefore, we were obliged to confine our work to investigating homes and cases, and visiting children. Even with this work, it was difficult to visit in some sections where the epidemic was most prevalent.

Two of the children in our care were stricken with the disease, one a boy five months old, who was in the care of its mother, under our supervision. This child died. The other case, that of a colored crippled idiot boy, aged eight years, recovered and is now under treatment.

You will note in the table of comparison that at the end of our fiscal year, 1915, we had 28 children in the almshouses, against 47 at the end of the fiscal year, 1916. This increase is also due to the epidemic, as we were unable to remove the normal children who were in the almshouses when the quarantine was placed on them.

The following tables of statistics will give you our work in detail for the past year:

Report from November 1, 1915, to November 1, 1916.

Number to be accounted for,	1,994
In care of Board at beginning of year,	1,568
In almshouses October 31, 1915,	28
Committed from November 1, 1915, to November 1, 1916,...	398
	<hr/> 1,994
 In care of Board at close of year,	 1,688
In almshouses October 31, 1916,	47
Discharged from November 1, 1915, to November 1, 1916,....	259
	<hr/> 1,994

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Placed out—

In families at board,	235	
In families free of charge,	63	
In institutions at board,	43	
In institutions free of charge,	25	
	<hr/>	366

Visits—

Investigating family history of children,	9,182	
Investigating homes applying for children,	3,027	
Visits to children placed in families,	3,734	
	<hr/>	15,943

Discharged from care of Board—

From almshouses,	6	
From families at board,	58	
From families free of charge,	152	
Died in almshouses,	7	
Died in families,	6	
Died in hospitals,	15	
Legally adopted,	15	
	<hr/>	259

Applications to take children—

Roman Catholic,	101	
Protestant,	206	
Jewish,	9	
	<hr/>	316

TABLE SHOWING PREVENTIVE WORK DONE DURING THE YEAR.

Children given a physical examination upon commitment,	398
Number of operations for removal of enlarged tonsils and adenoids,....	27
Number of operations for orthopædic diseases and braces fitted,.....	21
Number of operations for circumcision,	4
Number of children examined for eye trouble and glasses fitted,.....	36
Number of operations for appendicitis,	4
Number of operations for ear trouble,	8
Number of operations for prolapsis of rectum,	1
Number of operations for cleft palate,	1
Number of children treated by dentist,	134

NUMBER OF CHILDREN COMMITTED UNDER THE JUVENILE COURT ACT FROM MARCH 14, 1910, TO OCTOBER 31, 1916.

Hudson County,	30
Mercer County,	3
Monmouth County,	1
Union County,	4
Essex County,	2
Morris County,	1
Salem County,	1
	<hr/>
Number of children returned to Court,	27

Number of children in care of Board October 31, 1916, 15

STATE BOARD OF CHILDREN'S GUARDIANS. 11

NUMBER OF CHILDREN COMMITTED UNDER THE CHILD WELFARE ACT OF 1915, FROM
OCTOBER 31, 1915, TO OCTOBER 31, 1916.

Monmouth County,	7
Passaic City,	2
Sussex County,	2
Total	11

NUMBER OF CHILDREN COMMITTED UNDER AN "ACT PROVIDING FOR THE CREATION
OF A JUVENILE COURT," LAWS 1912.

Essex County,	45
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CALENDAR OF COMMITTED CASES FOR THE YEAR, NOVEMBER 1, 1915, TO NOVEMBER
1, 1916.

Desertion of parent or parents, 70; non-employment of parent or parents, 16; imprisonment of parent or parents, 56; death of parent or parents, 78; defective parent or parents, 42; illness of parent or parents, 29; defective children, 7; foundlings, 13; orphans, 27; committed under Juvenile Court Act of 1910, 4; committed under Child Welfare Act of 1915, 11; committed under Juvenile Court Act of 1912, 45. Total, 398.

NATIONALITY OF CHILDREN COMMITTED.

American, 131; Irish, 60; Jewish, 15; German, 52; Italian, 58; Polish, 55; Swedish, 3; Hungarian, 3; Slavish, 1; English, 2; unknown, 18. Total, 398.

AGES OF CHILDREN COMMITTED.

Under two years, 8; two to five years, 106; five to ten years, 150; ten to fifteen years, 58; over fifteen years, 3. Total, 398.

FOUNDLINGS COMMITTED FROM

Jersey City, 2; Hoboken, 1; West Hoboken, 2; Newark City, 2; Trenton City, 3; Camden County, 1; Caldwell Borough, 1; Westfield Town, 1. Total, 13.

RELIGION OF CHILDREN.

	Committed in Year.	In Almshouses Nov. 1, 1916.	Boarding Homes Nov. 1, 1916.	Free Homes Nov. 1, 1916.	Discharged in Year.	Total in Care in Year.
Roman Catholic,	212	30	589	352	178	1,361
Protestant,	144	13	287	343	61	848
Jewish,	15	1	36	15	6	73
Unknown,	27	3	21	45	14	110
Total,	398	47	933	755	259	2,392

12 STATE BOARD OF CHILDREN'S GUARDIANS.

CHILDREN IN INSTITUTIONS NOVEMBER 1, 1916.

	<i>Boarding.</i>	<i>Free.</i>	<i>Total.</i>
Industrial Schools,	32	10	42
Institutions for feeble-minded, .....	..	32	32
State Village for Epileptics, .....	..	5	5
Other institutions—temporarily,	133	5	138
			<hr/>
			217

STATE BOARD OF CHILDREN'S GUARDIANS. 13

LIST OF COUNTIES, CITIES, TOWNSHIPS AND BOROUGHES FROM WHICH CHILDREN HAVE BEEN COMMITTED SINCE THE CREATION OF THIS BOARD, TO DATE; THE NUMBER OF SUCH CHILDREN NOW IN THE CARE OF THE STATE BOARD, AND THE NUMBER DISCHARGED FROM OUR CARE.

	Committed in Year.	IN CARE OF BOARD, NOV. 1, 1916.			Discharged in Year.	Previously Discharged.	In Almshouses.	Grand Total.
		Boarding.	Free.	Total.				
Atlantic County,	0	0	0	0	0	2	1	3
Bergen County,	0	0	1	1	0	27	0	28
Bloomfield Town,	1	1	2	3	1	11	0	15
Burlington County,	9	24	34	58	2	162	2	224
Camden County,	4	8	11	19	2	82	3	106
Cape May County,	2	6	5	11	0	13	0	24
Cumberland County,	3	2	2	4	0	28	1	33
Dover Township,	0	0	0	0	0	1	0	1
East Orange City,	3	3	1	4	0	9	0	13
Elizabeth City,	4	8	7	15	3	34	1	53
Englewood City,	2	0	1	1	2	5	0	8
Franklin Township,	0	0	0	0	0	10	0	10
Gloucester County,	0	3	3	6	0	31	0	37
Glen Ridge Town,	0	0	1	1	0	1	0	2
Howell Township,	0	2	0	2	0	4	0	6
Hillsboro Township,	0	0	0	0	0	1	0	1
Hudson County,	207	622	437	1059	182	1648	22	2911
Keyport Town (Raritan T'ship),	0	0	0	0	0	11	0	11
Lakewood Town,	0	0	0	0	0	6	0	6
Little Falls Township (West-								
Paterson Borough),	0	3	1	4	1	6	0	11
Long Branch City,	0	1	0	1	0	11	0	12
Millburn Township,	0	1	1	2	0	1	0	3
Montclair Town,	1	3	2	5	2	21	0	28
Morris County,	1	1	0	1	0	23	0	24
Mountainside Borough,	0	0	0	0	0	1	0	1
Middletown Township,	0	0	0	0	0	1	0	1
Manchester Township (Hale-								
don Borough),	0	0	3	3	1	2	0	6
Newark City,	31	105	73	178	28	208	1	415
New Providence,	0	0	0	0	0	4	0	4
N. Plainfield Township,	2	2	2	4	0	1	0	5
Orange City,	0	11	3	14	0	16	0	30
Passaic City,	14	11	9	20	0	5	0	25
Paterson City,	0	1	10	11	0	44	0	55
Perth Amboy,	4	5	6	11	2	8	1	22
Piscataway Township,	0	0	2	2	0	3	0	5
Plainfield City,	1	7	6	13	1	23	0	37
Plumstead Township,	0	0	0	0	0	1	0	1
Rahway City,	0	1	0	1	3	3	0	7
Salem County,	1	6	14	20	0	22	0	42
Sayreville Township,	0	0	0	0	0	1	0	1
South Amboy Borough,	0	0	0	0	0	6	0	6
S. Brunswick Township,	0	0	1	1	1	1	0	3
Summit City,	4	0	3	3	1	2	0	6
Sussex County,	5	23	17	40	5	45	3	93
Trenton City,	12	10	19	29	7	57	5	98
Union Township (Union Co.),	0	0	0	0	0	2	0	2
Upper Freehold Township,	0	0	0	0	0	2	0	2
Warren County,	9	14	18	32	0	24	3	59
Westfield Town,	1	0	0	0	2	13	0	15
West Amwell Township,	0	0	1	1	0	1	0	2
Woodbridge Township,	2	2	3	5	0	10	0	15
West Milford Township,	0	0	2	2	0	3	0	5
Wall Township,	0	0	0	0	0	1	0	1
Cedar Grove (Verona T'ship),	0	0	0	0	1	0	0	1
Borough of Somerville (Bridge-								
water Township),	0	3	3	6	0	9	0	15
Wayne Township,	0	2	0	2	0	0	0	2

14 STATE BOARD OF CHILDREN'S GUARDIANS.

LIST OF COUNTIES, CITIES, TOWNSHIPS AND BOROUGHs FROM WHICH CHILDREN HAVE BEEN COMMITTED SINCE THE CREATION OF THIS BOARD, TO DATE; THE NUMBER OF SUCH CHILDREN NOW IN THE CARE OF THE STATE BOARD, AND THE NUMBER DISCHARGED FROM OUR CARE—Continued.

	Committed in Year.	IN CARE OF BOARD, NOV. 1, 1916.			Discharged in Year.	Dis- charged.	In Almshouses.	Grand Total.
		Boarding.	Free.	Total.				
Springfield Township,	0	0	0	0	0	2	0	2
Union Township (Hunterdon County),	0	1	1	2	0	0	0	2
Clark Township (Union Co.), ..	0	0	0	0	0	2	0	2
Roselle Borough,	0	0	0	0	0	16	0	16
Delaware Township (Hunterdon County),	0	0	1	1	0	0	0	1
Acquackanock Township,	0	2	0	2	0	0	0	2
Holland Township (Hunterdon County),	0	0	1	1	0	0	0	1
West Orange City,	0	1	0	1	0	0	0	1
Bound Brook,	0	0	1	1	0	0	0	1
Shrewsbury Township,	0	0	4	4	0	0	0	4
Linden Township,	2	3	2	5	0	1	0	6
Belleville Township,	0	0	0	0	0	2	0	2
Hopewell Township,	0	0	0	0	0	2	0	2
Montgomery Township,	0	0	0	0	0	2	0	2
Union County,	0	0	6	6	0	1	0	7
Monmouth County,	7	4	3	7	0	1	0	8
Middlesex County,	0	0	2	2	0	0	0	2
Asbury Park,	0	0	0	0	0	4	0	4
Lambertville,	0	0	0	0	0	2	0	2
South Ridge Borough,	0	1	0	1	0	0	0	1
Red Bank,	0	0	0	0	0	1	0	1
Stockton,	0	0	0	0	0	1	0	1
New Brunswick,	7	4	5	9	0	2	0	11
Clinton Township (Hunterdon County),	0	0	4	4	0	0	0	4
N. Plainfield Borough,	0	0	1	1	0	0	0	1
Essex County,	49	23	17	40	11	0	0	51
Hammonton (Atlantic Co.), ...	0	0	1	1	0	0	0	1
Atlantic City,	0	0	0	0	0	1	0	1
Ocean County (Berkley Town- ship),	0	0	0	0	0	2	0	2
Town of Allendale (Bergen County),	1	0	0	0	0	0	1	1
Township of Union (Bergen County),	2	0	0	0	0	0	2	2
Chrome (Middlesex Co.),	1	0	0	0	0	0	1	1
Scotch Plains,	1	1	0	1	0	0	0	1
Princeton,	1	0	1	1	0	0	0	1
Upper Macopin,	1	0	1	1	0	0	0	1
Caldwell Borough,	1	1	0	1	0	0	0	1
Kingwood Township (Hunterdon County),	1	1	0	1	0	0	0	1
Garwood,	1	0	0	0	1	0	0	1
Totals,	398	933	755	1688	259	2709	47	4703

STATE BOARD OF CHILDREN'S GUARDIANS. 15'

COMPARISON OF WORK.

	1915.	1916.	Increase.	Decrease.
Children committed,	412	398	0	14
Children placed,	382	366	0	16
Visits to investigate cases, homes and to see children,	15,910	15,943	33	0
Applications to take children,	292	316	14	0
Children in almshouses at end of fiscal year, ..	28	47	19	0
Children in care of Board at end of fiscal year, ..	1,568	1,688	120	0
Percentage of children in free homes,	44%	45%	1%	0

WORK DONE DURING THE YEAR UNDER "AN ACT TO PROMOTE HOME LIFE FOR DEPENDENT CHILDREN, COMMONLY CALLED THE WIDOWS' PENSION."

You will note by the summary of "Work Done" that we are gradually catching up with our petition work. At the end of the fiscal year there were 434 petitions awaiting hearing throughout the State, as against 1,031 at the end of last year.

The cleaning up of these petitions increases our responsibilities in reference to our follow-up work in the families. We have at the present time 3,190 children in the homes of their mothers, who have been committed to us, and who, under the law, we are required to visit six times a year. With the present staff of field workers we cannot hope to visit these children more than three times during the coming year.

We feel that the close supervision of the families after their commitment to us is the essential work of this Department. Our experience has shown us, with the few families we have been able to follow closely, that the health and general living conditions of the children have been greatly improved.

In all the cases where we have had a suspicion as to the mentality of the children we have referred the case to the Commissioner of Charities, who has given us the heartiest co-operation, and in all these cases has had a test made by the State Psychologist connected with his department. In many of these cases, where the report showed the child defective, we have been unable to get the mother to consent to sign an application blank for the admission of the child to the proper institution. In cases where the mother has signed the application blank, it has been filed with the Commissioner of Charities, but owing to the present situation in reference to admissions to the State Institution for Feeble-Minded, we have not as yet been able to have any admitted.

Two of the children in the care of this Department died of infantile paralysis during the epidemic.

The following table of statistics will give you our work in detail by counties for the past year, also a summary of the work done throughout the State, with the amount of money paid the widows through this Department by order of the court.

ATLANTIC COUNTY.

- 1 petition was awaiting hearing at the beginning of the fiscal year, and
- 3 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 25 petitions have been filed.
- 3 hearings have been held.
- 19 petitions have been heard.
- 5 families have been committed to our care.
- 11 petitions have been denied.

16 STATE BOARD OF CHILDREN'S GUARDIANS.

- 3 petitions have been withdrawn.
 - 4 decisions have been reserved by the court.
 - 0 orders have been revoked.
 - 270 visits have been made in investigating petitions.
 - 7 petitions awaiting hearing at the end of the fiscal year.
 - 12 children committed.
 - 5 children discharged.
 - 251 visits have been made inspecting children.
 - 415 visits have been made in supervising homes and following up adverse reports.
 - 78 children were in the care of the Board at the beginning of the fiscal year, and
 - 85 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$6,490.48.

BERGEN COUNTY.

- 17 petitions were awaiting hearing at the beginning of the fiscal year.
 - 18 petitions were awaiting the decision of the court at the beginning of the fiscal year.
 - 31 petitions have been filed.
 - 4 hearings have been held.
 - 33 petitions have been heard.
 - 22 families have been committed to our care.
 - 10 petitions have been denied.
 - 0 petitions have been withdrawn.
 - 22 decisions have been reserved by the court.
 - 223 visits were made in investigating petitions.
 - 15 petitions awaiting hearing at the end of the fiscal year.
 - 72 children committed.
 - 36 children discharged.
 - 338 visits have been made inspecting children.
 - 375 visits have been made in supervising homes and following up adverse reports.
 - 202 children were in the care of the Board at the beginning of the fiscal year, and
 - 238 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$15,828.80.

BURLINGTON COUNTY.

- 2 petitions were awaiting hearing at the beginning of the fiscal year.
 - 9 petitions were awaiting the decision of the court at the beginning of the fiscal year.
 - 10 petitions have been filed.
 - 5 hearings have been held.
 - 11 petitions have been heard.
 - 8 families have been committed to our care.
 - 7 petitions have been denied.
 - 1 petition has been withdrawn.
 - 4 decisions have been reserved by the court.
 - 189 visits have been made in investigating petitions.
 - 1 petition was awaiting hearing at the end of the fiscal year.
 - 30 children committed.
 - 20 children discharged.
 - 187 visits have been made inspecting children.
 - 210 visits have been made in supervising homes and following up adverse reports.
 - 69 children were in the care of the Board at the beginning of the fiscal year, and
 - 79 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$5,689.70.

CAMDEN COUNTY.

- 25 petitions were awaiting hearing at the beginning of the fiscal year, and
- 5 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 42 petitions have been filed.
- 7 hearings have been held.
- 58 petitions have been heard.

STATE BOARD OF CHILDREN'S GUARDIANS. 17

- 30 families have been committed.
- 37 petitions have been denied.
- 2 petitions have been withdrawn.
- 7 decisions have been reserved by the court.
- 4 orders have been revoked.
- 428 visits have been made in investigating petitions.
- 9 petitions awaiting hearing at the end of the fiscal year.
- 86 children committed.
- 21 children discharged.
- 401 visits have been made inspecting children.
- 521 visits have been made in supervising homes and following up adverse reports.
- 171 children were in the care of the Board at the beginning of the fiscal year.
- 236 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$15,228.03.

CAPE MAY COUNTY.

- 3 petitions were awaiting hearing at the beginning of the fiscal year.
- 2 petitions have been filed.
- 3 hearings have been held.
- 4 petitions have been heard.
- 2 families have been committed.
- 2 petitions have been denied.
- 0 petitions have been withdrawn.
- 2 decisions have been reserved by the court.
- 27 visits have been made in investigating petitions.
- 1 petition awaiting hearing at the end of the fiscal year.
- 7 children have been committed.
- 3 children have been discharged.
- 42 visits have been made inspecting children.
- 40 visits have been made in supervising homes and following up adverse reports.
- 16 children were in the care of the board at the beginning of the fiscal year.
- 20 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$1,464.32.

CUMBERLAND COUNTY.

- 4 petitions were awaiting hearing at the beginning of the fiscal year.
- 2 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 6 petitions have been filed.
- 2 hearings have been held.
- 6 petitions have been heard.
- 3 petitions have been denied.
- 4 families have been committed to our care.
- 0 petitions have been withdrawn.
- 1 decision has been reserved by the court.
- 79 visits have been made in investigating petitions.
- 4 petitions awaiting hearing at the end of the fiscal year.
- 20 children committed.
- 5 children discharged.
- 21 children were in the care of the Board at the beginning of the fiscal year, and
- 36 children were in the care of the Board at the end of the fiscal year.
- 61 visits have been made inspecting children.
- 62 visits have been made in supervising homes and following up adverse reports.
- Amount of money paid to the widows by order of the court, \$2,101.87.

ESSEX COUNTY.

- 260 petitions were awaiting hearing at the beginning of the fiscal year, and
- 24 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 110 petitions have been filed.

18 STATE BOARD OF CHILDREN'S GUARDIANS.

- 17 hearings have been held.
 - 227 petitions have been heard.
 - 121 petitions have been denied.
 - 18 petitions have been withdrawn.
 - 49 decisions have been reserved by the court.
 - 3 cases went off the calendar.
 - 2494 visits have been in investigating petitions.
 - 143 petitions awaiting hearing at the end of the fiscal year.
 - 60 families have been committed.
 - 202 children committed.
 - 35 children discharged.
 - 3 orders revoked by court.
 - 467 visits have been made inspecting children.
 - 614 visits have been made in supervising homes and following up adverse reports.
 - 240 children were in the care of the Board at the beginning of the fiscal year, and
 - 407 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$22,779.61.

GLOUCESTER COUNTY.

- 0 petitions were awaiting hearing at the beginning of the fiscal year.
 - 3 petitions were awaiting the decision of the court at the beginning of the fiscal year.
 - 5 petitions have been filed.
 - 1 hearing has been held.
 - 5 petitions were heard.
 - 6 petitions have been denied.
 - 0 decisions have been reserved by the court.
 - 42 visits have been made in investigating petitions.
 - 0 petitions awaiting hearing at the end of the fiscal year.
 - 2 families have been committed to our care.
 - 3 children committed.
 - 6 children discharged.
 - 57 visits have been made inspecting children.
 - 62 visits have been made in supervising homes and following up adverse reports.
 - 19 children were in the care of the Board at the beginning of the fiscal year, and
 - 16 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court \$1,340.57.

HUDSON COUNTY.

- 527 petitions were awaiting hearing at the beginning of the fiscal year, and
 - 12 petitions were awaiting the decision of the court at the beginning of the fiscal year.
 - 152 petitions have been filed.
 - 18 hearings have been held.
 - 521 petitions have been heard.
 - 338 petitions have been denied.
 - 45 petitions have been withdrawn.
 - 33 decisions have been reserved by the court.
 - 2 orders have been revoked.
 - 4079 visits have been made in investigating petitions.
 - 158 petitions awaiting hearing at the end of the fiscal year.
 - 117 families have been committed to our care.
 - 283 children committed.
 - 62 children discharged.
 - 824 visits have been made inspecting children.
 - 759 visits have been made in supervising homes and following up adverse reports.
 - 227 children were in the care of the Board at the beginning of the fiscal year, and
 - 448 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$25,952.85.

STATE BOARD OF CHILDREN'S GUARDIANS. 19

HUNTERDON COUNTY.

- 3 petitions were awaiting hearing at the beginning of the fiscal year, and
- 1 petition was awaiting the decision of the court at the beginning of the fiscal year.
- 8 petitions have been filed.
- 2 hearings have been held.
- 6 petitions have been heard.
- 2 families have been committed to our care.
- 4 petitions have been denied.
- 1 decision has been reserved by the court.
- 51 visits have been made in investigating petitions.
- 5 petitions awaiting hearing at the end of the fiscal year.
- 7 children committed.
- 0 children discharged.
- 22 visits have been made inspecting children.
- 28 visits have been made in supervising homes and following up adverse reports.
- 18 children were in the care of the Board at the beginning of the fiscal year.
- 25 children were in the care of the Board at the end of the fiscal.
- Amount of money paid to the widows by order of the court, \$1,625.61.

MERCER COUNTY.

- 34 petitions were awaiting hearing at the beginning of the fiscal year, and
- 20 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 58 petitions have been filed.
- 5 hearings have been held.
- 83 petitions have been heard.
- 32 petitions have been denied.
- 57 families have been committed to our care.
- 1 petition has been withdrawn.
- 13 decisions have been reserved by the court.
- 3 orders have been revoked.
- 617 visits have been made in investigating petitions.
- 9 petitions awaiting hearing at the end of the fiscal year.
- 158 children committed.
- 23 children discharged.
- 269 visits have been made inspecting children.
- 301 visits have been made in supervising homes and following up adverse reports.
- 168 children were in the care of the Board at the beginning of the fiscal year, and
- 303 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$15,486.37.

MIDDLESEX COUNTY.

- 16 petitions were awaiting hearing at the beginning of the fiscal year, and
- 12 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 27 petitions have been filed.
- 35 petitions have been heard.
- 5 hearings have been held.
- 24 families have been committed to our care.
- 18 petitions have been denied.
- 0 petitions have been withdrawn.
- 6 decisions have been reserved by the court.
- 297 visits have been made in investigating petitions.
- 8 petitions awaiting hearing at the end of the fiscal year.
- 70 children committed.
- 59 children discharged.
- 384 visits have been made inspecting children.
- 539 visits have been made in supervising homes and following up adverse reports.
- 215 children were in the care of the Board at the beginning of the fiscal year, and
- 226 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$16,353.85.

20 STATE BOARD OF CHILDREN'S GUARDIANS.

MONMOUTH COUNTY.

- 35 petitions were awaiting hearing at the beginning of the fiscal year, and
- 11 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 24 petitions have been filed.
- 5 hearings have been held.
- 49 petitions have been heard.
- 21 families have been committed to our care.
- 34 petitions have been denied.
- 2 petitions have been withdrawn.
- 5 decisions have been reserved by the court.
- 573 visits have been made in investigating petitions.
- 10 petitions awaiting hearing at the end of the fiscal year.
- 51 children committed.
- 29 children discharged.
- 368 visits have been made inspecting children.
- 472 visits have been made in supervising homes and following up adverse reports.
- 184 children were in the care of the Board at the beginning of the fiscal year, and
- 206 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$15,299.02.

MORRIS COUNTY.

- 15 petitions were awaiting hearing at the beginning of the fiscal year, and
- 19 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 20 petitions have been filed.
- 3 hearings have been held.
- 26 petitions have been heard.
- 14 families have been committed to our care.
- 23 petitions have been denied.
- 4 petitions have been withdrawn.
- 3 decisions have been reserved by the court.
- 184 visits have been made in investigating petitions.
- 9 petitions awaiting hearing at the end of the fiscal year.
- 37 children committed.
- 22 children discharged.
- 385 visits have been made inspecting children.
- 454 visits have been made in supervising homes and following up adverse reports.
- 111 children were in the care of the Board at the beginning of the fiscal year, and
- 126 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$8,925.13.

OCEAN COUNTY.

- 1 petition was awaiting hearing at the beginning of the fiscal year.
- 1 petition awaiting the decision of the court at the beginning of the fiscal year.
- 6 petitions have been filed.
- 3 hearings have been held.
- 6 petitions have been heard.
- 1 family has been committed to our care.
- 0 petitions have been withdrawn.
- 3 decisions have been reserved by the court.
- 42 visits have been made in investigating petitions.
- 1 petition awaiting hearing at the end of the fiscal year.
- 4 children committed.
- 0 children have been discharged.
- 24 visits have been made inspecting children.
- 10 visits have been made in supervising homes and following up adverse reports.
- 9 children were in the care of the Board at the beginning of the fiscal year, and
- 13 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$721.64.

STATE BOARD OF CHILDREN'S GUARDIANS. 21

PASSAIC COUNTY.

- 17 petitions were awaiting hearing at the beginning of the fiscal year, and
- 16 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 70 petitions have been filed.
- 2 hearings have been held.
- 77 petitions have been heard.
- 52 families have been committed to our care.
- 28 petitions have been denied.
- 3 petitions have been withdrawn.
- 10 decisions have been reserved by the court.
- 12 orders have been revoked.
- 660 visits have been made in investigating petitions.
- 10 petitions awaiting hearing at the end of the fiscal year.
- 176 children committed.
- 49 children discharged.
- 641 visits have been made inspecting children.
- 613 visits have been made in supervising homes and following up adverse reports.
- 226 children were in the care of the Board at the beginning of the fiscal year, and
- 303 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$19,303.73.

SALEM COUNTY.

- 1 petition was awaiting hearing at the beginning of the fiscal year, and
- 1 petition was awaiting the decision of the court at the beginning of the fiscal year.
- 2 petitions have been filed.
- 0 hearings have been held.
- 0 petitions have been heard.
- 1 family has been committed to our care.
- 0 petitions have been denied.
- 0 petitions were withdrawn.
- 0 decisions have been reserved by the court.
- 0 orders have been revoked.
- 0 visits have been made in investigating petitions.
- 3 petitions awaiting hearing at the end of the fiscal year.
- 5 children committed.
- 17 visits have been made inspecting children.
- 1 child discharged.
- 10 visits have been made in supervising homes and following up adverse reports.
- 1 child was in the care of the Board at the beginning of the fiscal year, and
- 5 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$357.07.

SOMERSET COUNTY.

- 9 petitions were awaiting hearing at the beginning of the fiscal year, and
- 1 petition was awaiting the decision of the court at the beginning of the fiscal year.
- 3 petitions have been filed.
- 2 hearings have been held.
- 11 petitions have been heard.
- 5 families have been committed to our care.
- 6 petitions have been denied.
- 1 petition has been withdrawn.
- 0 decision has been reserved by the court.
- 2 orders have been revoked.
- 45 visits have been made in investigating petitions.
- 1 petition awaiting hearing at the end of the fiscal year.
- 9 children committed.

22 STATE BOARD OF CHILDREN'S GUARDIANS.

- 9 children discharged.
- 69 visits have been made inspecting children.
- 149 visits have been made in supervising homes and following up adverse reports.
- 39 children were in the care of the Board at the beginning of the fiscal year, and
- 39 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court \$3,144.89.

SUSSEX COUNTY.

- 4 petitions were awaiting hearing at the beginning of the fiscal year, and
- 9 petitions have been filed.
- 1 hearing has been held.
- 8 petitions have been heard.
- 4 families have been committed to our care.
- 3 petitions have been denied.
- 27 visits have been made in investigating petitions.
- 5 petitions awaiting hearing at the end of the fiscal year.
- 19 children committed.
- 9 children discharged.
- 78 visits have been made inspecting children.
- 97 visits have been made in supervising homes and following up adverse reports.
- 22 children were in the care of the Board at the beginning of the fiscal year, and
- 32 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$2,241.48.

UNION COUNTY.

- 55 petitions were awaiting hearing at the beginning of the fiscal year, and
- 3 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 47 petitions have been filed.
- 7 hearings have been held.
- 68 petitions have been heard.
- 38 families have been committed to our care.
- 23 petitions have been denied.
- 4 petitions have been withdrawn.
- 11 decisions have been reserved by the court.
- 11 orders have been revoked.
- 623 visits have been made in investigating petitions.
- 34 petitions awaiting hearing at the end of the fiscal year.
- 98 children committed.
- 64 children discharged.
- 512 visits have been made inspecting children.
- 941 visits have been made in supervising homes and following up adverse reports.
- 286 children were in the care of the Board at the beginning of the fiscal year, and
- 320 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court \$22,268.61.

WARREN COUNTY.

- 2 petitions were awaiting hearing at the beginning of the fiscal year, and
- 0 petitions were awaiting the decision of the court at the beginning of the fiscal year.
- 7 petitions have been filed.
- 2 hearings have been held.
- 8 petitions have been heard.
- 2 families have been committed to our care.
- 3 petitions have been denied.
- 1 petition has been withdrawn.
- 2 decisions have been reserved by the court.
- 2 orders have been revoked.

STATE BOARD OF CHILDREN'S GUARDIANS. 23

- 81 visits have been made in investigating petitions.
- 1 petition awaiting hearing at the end of the fiscal year.
- 3 children committed.
- 6 children have been discharged.
- 119 visits have been made in inspecting children.
- 102 visits have been made in supervising homes and following up adverse reports.
- 24 children were in the care of the Board at the beginning of the fiscal year, and
- 27 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$2,027.51.

SUMMARY OF WORK DONE THROUGHOUT THE STATE UNDER "AN ACT TO PROMOTE HOME LIFE FOR DEPENDENT CHILDREN," OCTOBER 31, 1915, TO OCTOBER 31, 1916.

- 664 petitions have been filed.
- 1261 petitions have been heard.
- 712 petitions have been denied.
- 85 petitions have been withdrawn.
- 434 petitions awaiting hearing at the end of the fiscal year.
- 177 decisions have been reserved by the court.
- 69 orders have been revoked.
- 11031 visits have been made investigating petitions.
- 97 hearings have been held.
- 466 families have been committed to our care.
- 1308 children have been committed.
- 464 children have been discharged.
- 5516 visits have been made inspecting children.
- 6774 visits have been made supervising homes and following up adverse reports.
- 2346 children were in the care of the Board at the beginning of the fiscal year, and
- 3190 children were in the care of the Board at the end of the fiscal year.
- Amount of money paid to the widows by order of the court, \$204,631.14.

Yours respectfully,

FRANCES DAY,
General Agent.

Treasurer's Report.

ROBERT L. FLEMMING, TREASURER WITH THE STATE OF NEW JERSEY, NOVEMBER 1ST, 1915,
TO OCTOBER 31ST, 1916.

Salaries,	\$14,150 28
Traveling expenses,	3,448 89
Stationery, printing, office furniture and supplies,	790 90
Rent,	667 50
Postage,	791 14
Telephone and telegrams,	79 51
Sundries (notary and advertising),	15 50
Express,	47 52

\$19,991 24

RECAPITULATION.

Appropriation,	\$20,000 00
Received from State Treasurer,	19,991 24

Balance appropriation, October 31st, 1916, \$8 76

CHAPTER 281, LAWS OF 1913,

NOVEMBER 1ST, 1915, TO OCTOBER 31ST, 1916.

Salaries,	\$10,473 70
Traveling expenses,	2,897 00
Stationery, printing, office furniture and supplies,	1,111 69
Rent,	1,048 50
Postage,	1,170 20
Telephone and telegrams,	171 98
Sundries (Insurance and Steno. Medical Ex.),	27 20

\$16,900 27

RECAPITULATION.

Appropriation,	\$15,000 00
Supplement appropriation,	2,000 00

\$17,000 00

Received from State Treasurer,	16,900 27
--------------------------------------	-----------

Balance appropriation, October 31st, 1916, \$99 73

STATE BOARD OF CHILDREN'S GUARDIANS. 25

TREASURER'S REPORT WITH COUNTIES

FROM

NOVEMBER 1ST, 1915, TO OCTOBER 31ST, 1916.

AN ACT TO PROMOTE HOME LIFE FOR DEPENDENT CHILDREN.

CHAPTER 281, LAWS OF 1913.

	<i>Bills Rendered.</i>	<i>Amount Paid.</i>	<i>Balance Due.</i>
Atlantic County,	\$6,490 48	\$5,951 48	\$539 00
Bergen County,	15,828 80	14,419 13	1,409 67
Burlington County,	5,689 70	5,217 99	471 71
Camden County,	15,228 03	13,689 45	1,538 58
Cape May County,	1,464 32	1,337 32	127 00
Cumberland County,	2,101 87	2,101 87	.....
Essex County,	22,779 61	20,613 21	2,166 40
Gloucester County,	1,340 57	1,229 57	111 00
Hudson County,	25,952 85	23,079 39	2,873 46
Hunterdon County,	1,625 61	1,475 61	150 00
Mercer County,	15,486 37	13,810 48	1,675 89
Middlesex County,	16,353 85	14,989 85	1,364 00
Monmouth County,	15,299 02	14,024 99	1,274 03
Morris County,	8,925 13	8,179 13	746 00
Ocean County,	721 64	591 80	129 84
Passaic County,	19,303 73	17,421 70	1,882 03
Salem County,	357 07	313 07	44 00
Somerset County,	3,144 89	2,893 89	251 00
Sussex County,	2,241 48	2,049 48	192 00
Union County,	22,268 61	20,472 81	1,795 80
Warren County,	2,027 51	1,875 16	152 35
	<hr/>	<hr/>	<hr/>
	\$204,631 14	\$185,737 38	\$18,893 76

This Report is made up to the end of the fiscal year, October 31st, 1916. Since that time all of these accounts have been paid.

26 STATE BOARD OF CHILDREN'S GUARDIANS.

TREASURER'S REPORT WITH COUNTIES, CITIES, TOWNS, HIPPS, AND BOROUGH, NOV. 1, 1915, TO OCT. 31, 1916.

	Board.	Clothing.	Medical and Dental.	Total.	Amount Paid.	Amount Due for Current Year.	Total Amount Due.
in.	\$82.56	\$16.31	\$15.11	\$113.08	\$100.70	\$13.38	\$13.38
an County,	7.28	38.90	1.00	7.28	103.02	30.28	7.28
	102.40				10.37		
	15.64	3.73		3.73	304.03		24.72
	235.23	88.62	5.80	263.05	100.14	15.54	15.54
	1,937.60	450.97	146.62	2,535.19	2,345.05	190.14	100.14
	9.00	7.05	1.85	17.90	2.36		24.72
Camden County,	759.46	238.54	38.45	1,036.45	903.42	23.03	23.03
Cape May County,	364.92	144.41	18.08	527.41	502.06	25.35	25.35
Cumberland County,	118.85	32.75	17.05	168.65	148.77	19.88	19.88
East Orange City,	185.31	77.68	18.78	281.77	248.33	33.44	33.44
Elizabeth City,	781.29	262.20	49.77	1,093.26	918.11	175.15	175.15
Essex County,	1,021.35	378.29	110.44	1,510.08	1,247.80	262.28	262.28
Garwood Township,	17.90			17.90			
Gloucester County,	252.20	46.03	31.80	330.03	307.88	22.15	22.15
Haledon Borough,	36.63	8.14	60.74	105.51			
Hammon Township, Atlantic County,	6.00	8.51		14.51			
Howell Township,	363.96	32.00	5.40	401.36	64,032.25	401.36	14.51
Hudson County,	50,813.59	15,980.56	3,164.60	69,958.75	5,026.50	5,026.50	5,026.50
Kingwood Township,	16.93	12.25	33.39	62.57	108.10	14.62	14.62
Linden Town of,	72.40	12.25	12.25	96.90	243.05	30.20	30.20
Long Branch City,	66.00	15.63	2.50	84.13	76.40	7.73	7.73
Millburn Township,	78.41	15.74	7.60	101.75		101.75	101.75
Monmouth County,	270.28	144.53	34.52	449.33	351.24	98.09	98.09
Montclair Town,	319.28	73.03	13.93	406.24	370.22	36.02	36.02
Morris County,	5.57	1.81		7.38		7.38	7.38
Newark City,	8,205.05	2,326.36	696.44	11,227.85	10,340.11	887.74	887.74
New Brunswick City,	176.14	27.30	15.75	219.19	180.41	38.77	38.77
North Plainfield Borough,	44.98	30.79	12.50	88.27	40.44	47.83	47.83
North Plainfield Township,	35.71	12.50	52.02	100.23			
Orange City,	850.12	215.76	58.50	1,124.38	1,023.45	100.93	100.93
Passaic City,	484.12	70.44	18.59	573.15	466.66	106.49	106.49
Paterson City,	218.32	24.35	23.77	266.44	215.73	50.71	50.71
Berth Amboy City,	358.45	78.68	53.64	490.77	332.50	158.27	158.27
Plainfield City,	487.60	121.98	10.60	620.18	540.90	79.28	79.28
Plainfield Township,	1.50			1.50			
Princeton City,	12.21	17.48	4.95	34.64	19.89	14.75	14.75
Railway City,	78.41	22.55	22.55	123.46	114.87	8.59	8.59
Salem County,	375.56	107.01	49.40	531.97	491.07	40.90	40.90
Scotch Plains,	18.21	5.60		23.81	17.17	6.64	6.64

STATE BOARD OF CHILDREN'S GUARDIANS. 27

TREASURER'S REPORT WITH COUNTIES, CITIES, TOWNSHIPS, AND BOROUGH, NOV. 1, 1915, TO OCT. 31, 1916—(CONTINUED).

	Clothing.	Medical and Dental.	Total.	Amount Paid.	Amount Due for Current Year.	Total Amount Due.
South River Borough,	\$78 41	\$38 25	\$130 54	\$118 25	\$12 29	\$12 29
Summit City,	141 59	3 86	203 49	170 85	32 64	32 64
Sussex County,	1,872 85	107 05	2,456 35	2,248 10	208 25	208 25
Trenton City,	827 69	81 77	1,108 67	1,016 61	92 06	92 06
Union County,	224 24	24 94	306 66	300 02	6 64	6 64
Union Township, Hunterdon County, ..	78 41	.....	96 12	89 48	6 64	6 64
Warren County,	1,423 10	81 51	1,887 31	1,719 55	167 76	167 76
Wayne Township,	158 46	.....	202 13	172 30	29 83	29 83
West Milford Township,	20 21	6 10	32 86	32 86	.....	.....
West Orange Town,	78 41	.....	95 03	84 97	10 06	10 06
West Paterson Borough,	235 23	8 05	320 86	.....	320 86	714 41
Woodbridge Township,	10 72	.....	10 72	.....	10 72	10 72
	\$74,682 07	\$5,084 45	\$102,334 10	\$92,314 70	\$9,997 61	\$11,412 74

Received from parents of children from Cape May County, \$41.00; received from parents of children from Elizabeth City, \$7.50; received from parents and relatives of children from Newark City, \$87.50; received from parents of children from Salem County, \$2.00; received for child from Trenton City, \$2.00.

Above items are credited to amounts paid by counties and cities. This report is made up to the end of the fiscal year, October 31st, 1916.

Since that time many of these accounts have been paid in full.

R. L. FLEMING, Treasurer.

Document No. 46

ANNUAL REPORT

OF THE

Department of Conservation
and Development

FOR THE

Year ending October 31st, 1916

THE WRONG METHOD OF BURNING BRUSH
A LARGE AND VERY HOT FIRE



THE WRONG METHOD OF BURNING BRUSH
BRUSH PILED IN LONG WINROWS



THE WRONG METHOD OF BURNING
BRUSH
NUMEROUS PILES ALL FIRED AT ONCE



REPORTS OF THE
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
STATE OF NEW JERSEY

ANNUAL REPORT

For the Year Ending October 31,
1916

Department of
Conservation and Development

SUCCEEDING
THE GEOLOGICAL SURVEY
THE FOREST PARK RESERVATION COMMISSION
THE STATE MUSEUM COMMISSION
THE STATE WATER-SUPPLY COMMISSION
THE WASHINGTON CROSSING PARK COMMISSION
THE FORT NONSENSE PARK COMMISSION

TRENTON, N. J.
MACCRELLISH & QUIGLEY Co., State Printers

1917

The Board of Conservation and Development.

WALTER J. BUZBY, *President*,Atlantic City
SIMON P. NORTHRUP,Newark
EDWARD S. SAVAGE,Rahway
CHARLES L. PACK,Lakewood
GEORGE A. STEELE,Eatontown
NELSON B. GASKILL,Trenton
STEPHEN PFEIL,Camden
HENRY CROFUT WHITE,North Plainfield

ALFRED GASKILL, Lawrenceville,*State Forester and Director*
HENRY B. KÜMMEL, Trenton,*State Geologist*
CHARLES P. WILBER, New Brunswick,*State Firewarden*

OFFICE, STATE HOUSE, TRENTON.

Letter of Transmittal.

To His Excellency, James F. Fielder, Governor:

SIR—I have the honor to submit for your information, and for transmittal to the Legislature as required by law, the annual report of the Department of Conservation and Development for the fiscal year ending October 31, 1916. It comprises reports of the Board, the State Geologist, the State Forester and the State Firewarden.

By direction of the Board of Conservation and Development.

Very respectfully yours,

HENRY B. KÜMMEL,

Acting Director.

State House, December 30, 1916.

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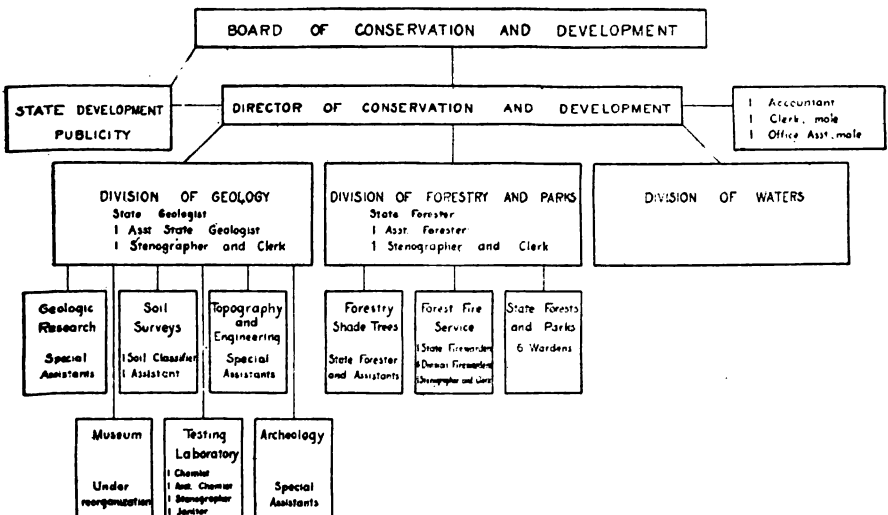
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Report of the Board of Conservation and Development.

ORGANIZATION.

During the year there have been no changes in the plan of organization of the Department except that made necessary by taking over on July 1, 1916, the duties of the State Water-Supply Commission. The Board, after full consideration of the new work, created a Division of Geology and Waters, under the direction of Henry B. Kümmel, State Geologist, as Chief, instead of maintaining separate divisions for Geology and for Water Resources as had at first been contemplated. The position of Water Engineer was created, and those of Consulting Engineer and of Assistant Engineer abolished. The organization of the Department is shown by the accompanying diagram.

DEPARTMENT OF CONSERVATION AND DEVELOPMENT



WORK OF THE DEPARTMENT.

The functions of the Board are manifold. As successor to the Geological Survey, it is charged with the investigation of all the mineral resources of the State, including water; with the preparation and publication of topographic, geologic, and other maps; with soil classification and mapping; with the maintenance of a chemical and testing laboratory, both for the furtherance of its own researches and for testing material for other departments, notably the Department of Public Roads and the State Purchasing Agent; with special engineering investigations as from time to time required by the Legislature. As successor to the Forest Park Reservation Commission and several other boards, it fosters the practice of scientific forestry by private land owners; administers the State forest reserves with a view to their development as revenue producers and as public parks; prevents forest fires on both public and private forests; encourages the planting and care of shade trees; has charge of Swartswood Lake in Sussex County and of the Washington Crossing Park, near Trenton. From the State Water-Supply Commission it received jurisdiction over the distribution and diversion of all potable water supplies, both surface and sub-surface; is charged with responsibility for the safety of dams and their proper construction; may gauge streams and investigate water powers. As successor to the State Museum Commission, it is charged with the development and maintenance of a museum, which shall be a credit to the State and an instrument in its development along material, educational and artistic lines. In addition to these duties it is invested "with full control and direction of all State conservation and development projects, and of all work in any way related thereto, except such as is conferred upon other boards."

The progress which has been made during the year in the performance of these duties is set forth in the reports of the State Geologist, State Forester, and State Firewarden, which accompany and are a part of this report.

In addition to the activities therein set forth, attention may be directed to two other phases of the Board's activity. In carrying out its plan of making public in a wider degree than heretofore the advantages of New Jersey as a place of residence and business, the Board recommended, and the Governor appointed, May 12 as New Jersey day, at which time appropriate meetings were held by many schools, by clubs, and by commercial organizations, all designed better to acquaint the people of New Jersey with their State, its history, resources, and advantages. In furtherance of this plan the Board prepared and distributed widely a circular entitled "New Jersey Invites You," from which a few paragraphs may be quoted:

1. *The center* of the densest organized population on earth lies in New Jersey. More than ten million people live within 60 miles of the State House at Trenton.

2. *The Home State.* To no other State do so many people with interests elsewhere come to make their homes. The popularity of our suburban communities is based upon accessibility, good air, good water, good schools, good living conditions.

3. *The resorts* of New Jersey attract more visitors than those of any other State. The entire coast from Sandy Hook to Cape May, a reach of 125 miles, is the chief summer playground of the country. Some of these seaside cities have a world-wide reputation. It is less well-known that there are also numerous quiet communities, and ample room for many times the number of visitors now provided for. About the lakes and on the hills of Morris, Passaic and Sussex counties are resorts of quite another character. Less well-known than those along the coast they attract people who love the hills, the woods and the quiet waters. In the pines of Burlington, Monmouth and Ocean counties is still another class of resorts, most attractive in the winter.

4. *The cities and towns* of New Jersey have grown more rapidly than those of any other eastern State. This is good in that it proves the attractions that are offered; it is harmful in that too large a part of the population lives under congested conditions.

5. *In manufacturing* New Jersey ranks second among the States in the per capita value of manufactured goods and sixth in the aggregate value of such products. The capital invested in the State is nearly twice as much as was invested in the whole United States in 1850. The variety of manufactures is great.

6. *The farms* of New Jersey are feeding the nearby multitude in increasing measure; their product in fruits, vegetables, poultry and milk is of the highest quality, yet farm land is cheaper than it is in many States having less favorable conditions.

The conditions which determine New Jersey's preëminent advantages are:

1. *Its location* at the heart of the Nation's greatest activity. Its nearness to the best markets; to the greatest supplies of fuel, and to the distribution points of raw materials of manufacture—metals, lumber, clay, wool, leather, etc.

2. *Its water front.* Nine-tenths of the State is water bounded; shipping of every class finds ample dockage in the great harbors of New York and Philadelphia, in the many lesser bays, or along its rivers. Behind the coast beaches is a safe waterway ninety miles long navigable by small vessels.

3. *The climate* of the whole State is moderate. In the hills of the north the summers are extremely pleasant, the winters often snow-bound. In the south snow lies but a short time, and the summers are freshened by the ocean and by the large area of forest. There are few seasons of excessive heat or excessive cold anywhere, and drouth is rare. The rainfall averages nearly four inches a month throughout the year.

4. *The soils* of the State vary from light, warm sands suitable for trucking to heavy loams for grain and roots, and stony slopes for tree fruits and pasture. In the central and southern sections tillage involves a minimum of labor.

5. *Transportation* is highly developed. Suburban sections are well served by steam roads, electric roads and highways. The State contains one mile of railroad (first track) to every three square miles of land and an extensive system of country roads. New Jersey was the first State in the Union to adopt the State-aid plan of road construction. It now has 7,344 miles of im-

proved roads. Of this 5,112 miles are country roads and 2,232 miles are in municipalities. The regular State appropriation for road construction (additional to county and township appropriations) is \$500,000 per year. The motor vehicle receipts available for road repairs are approximately \$1,000,000 a year.

6. *The school system* ranks among the highest in the country. Modern school buildings, well equipped for all phases of school work, are provided for the children of the State. Continued progress is being made along this line. The entire school system is under the direction of an efficient State Department of Education, assisted by a corps of county and city superintendents and supervising principals. Enthusiastic teachers are utilizing all means available to make the school work practical. During the school year 1914-15 there were 14,771 teachers in New Jersey schools; the total enrollment was 563,240; the total expenditure upwards of \$17,000,000, and the expenditure per pupil, based on attendance, \$41.96. There are 156 high schools in the State. The school property is valued at \$65,000,000.

7. *Nearly half the State is forested*, an assurance of agreeable living conditions. What are called pine barrens in South Jersey are not barren nor worthless, as is so often asserted, but areas which have been brought to a degraded condition by forest fires. This evil is steadily being brought under control. Much of the forest now growing on relatively good soil should give way to new people. New Jersey as a whole is densely populous; in spots it cries for more citizens.

8. *Fisheries.* The present, or the potential, value of the coast waters in supplying food is little appreciated. From not over two-fifths the area available for oyster and clam culture is produced annually upwards of five million dollars' worth of shell-fish. The value of other food fish taken in our waters is estimated at three millions more.

Farming.

New Jersey's strongest appeal at this time is to those who are looking toward the land for a living. Every section is in closest touch with city populations—essentially consuming

populations, whose prime needs are the products of the soil. Why go West or South or to Canada when the opportunity lies within 50 miles of New York or Philadelphia?

Our soils are of many kinds and adaptable to the widest range of crops. Under intensive culture some of this land is yielding in fruits and vegetables satisfactory returns on a valuation of \$1,000 an acre. The average annual yield of our farms is \$22.57 per improved acre; the farms of Iowa yield but \$10.66 per improved acre. There are within the State available for immediate development *a million acres of land* as good as that now under intensive cultivation. Three hundred and fifty thousand acres of the best grain and fruit land occupy the valleys and hillsides of Hunterdon, Morris, Passaic, Somerset, Sussex and Warren counties. Six hundred and fifty thousand acres lie in the southern half of the State, where the soil is light and easily worked and the growing season long.

Nowhere need the farmer live in a wilderness. Few farms are more than two miles from an improved highroad, or more than five miles from a railroad station. Telephone and daily mail reach every section. Schools, churches, stores, are never far off. *A family can live while making a living*, and can get instruction and help from the State Agricultural College and from two Agricultural Experiment Stations.

All these lands are in private possession. The State owns none. Run-down farms with buildings can be bought for \$40 an acre, or even less; cleared land without buildings for as little as \$20 an acre; uncleared or brush land, but the soil fit for many kinds of crops, for from \$5 to \$20 an acre. Some of the most successful orchards, berry and vegetable farms have been developed on this type of land. These prices seem ridiculously low in comparison with those that obtain in favored farming sections; they represent not inherent worthlessness, but an economic error.

Mosquitoes.

To aid the work being done by the State Entomologist and by the several County Mosquito Extermination Commissions, this Board issued and distributed 10,000 copies of a pamphlet emphasizing the practicability of mosquito-control work, the success which has attended the work already done, and the value to the State to complete the control and elimination of the salt-marsh mosquito. The Board of Conservation and Development endorses in the strongest terms the work which has already been done, and urges without qualification the importance of carrying it to an early completion.

Publicity.

Recognizing the fact that a vigorous publicity campaign must be of advantage to the State's development, the Board has formulated plans whereby the State and its resources will be advertised at home and abroad through the press, by attractive publications, and by lectures and exhibits. Coöperation is being sought with schools, boards of trade, railroads, and other organizations with the purpose of carrying the work from general publicity to specific propositions. In the development of this phase of its work the Board has been restricted by lack of sufficient funds. The work can be broadened in proportion to the amount of money available.

The Board regrets to record the fact that owing to ill health, the result of overwork, Mr. Alfred Gaskill, the Director of Conservation and Development, was early in September forced to request leave of absence, which was granted.

Respectfully submitted,

BOARD OF CONSERVATION AND DEVELOPMENT,
by HENRY B. KÜMMEL, *Acting Director.*

CASH RECEIPTS AND DISBURSEMENTS.

Receipts.

Balance on hand November, 1915,	\$204.56
Receipts from sales of Geologic maps and reports,	1,185.44
Receipts from analyses made at Testing Laboratory,	114.00
Receipts from American Express Co. for maps lost in shipping,..	25.00
Receipts from certified copies of records,	13.75
Receipts from sales of Forestry reports,	16.00
Receipts from sale of Mays Landing Forest Reserve,	8,264.00
Receipts from products of Forest Reserves,	53.00
Receipts from rent of house (Washington Crossing Park) and sale of old building materials,	332.50
Receipts from expenses of Foresters in coöperative work,	13.80
Receipts from settlements with Sundry Violators of Forest Fire Law,	1,724.57
	<hr/>
	\$11,946.62

Disbursements.

Paid to State Treasurer,	\$2,037.00
Paid to Sundry Township Treasurers,	1,385.59
Balance on hand October 31, 1916:	
Due State Treasurer,	\$8,491.53
Due Township Treasurers,	32.50
	<hr/>
	8,524.03
	<hr/>
	\$11,946.62

Report of the State Geologist.

HENRY B. KÜMMEL.

ADMINISTRATION.

Scope of Report.—This report covers the administrative work of the Division of Geology and Waters. The results of the scientific work of the Division are separately published as maps, bulletins, and final reports.

Organization.—From the beginning of the fiscal year to July 1, 1916, the Division of Geology comprised the Geological Survey, including the Testing Laboratory and the State Museum. On July 1, the Board of Conservation and Development assumed many of the duties of the State Water-Supply Commission. Instead, however, of establishing a Division of Waters, the work of this branch was placed under the direction of the State Geologist, and the name of the Division changed to "Geology and Waters." The positions of Consulting Engineer and Assistant Engineer under the old State Water-Supply Commission were abolished, and that of Water Engineer created, but to the end of the year no appointment had been made, W. H. Boardman, former Assistant Engineer of the State Water-Supply Commission, being retained, and acting in an advisory capacity.

The scientific staff of the Division has been as follows:

Henry B. Kümmel, State Geologist and Chief of Division.

M. W. Twitchell, Assistant State Geologist.

R. B. Gage, Chemist.

C. C. Engle, Soil Survey Expert.

Linwood L. Lee, Soil Survey Expert.

Helen C. Perry, Museum Organizer.

W. H. Boardman, Assistant Engineer.

C. C. Vermeule, Topographer and Consulting Engineer.

J. Volney Lewis, Geologist.

S. M. Sharkey, Clay Expert.

H. M. Miller, Soil Survey Assistant.

In addition to these, several of Mr. Vermeule's assistants were employed from time to time, either in the field or in the office, on revision of topographic maps, running lines of levels, and on engineering work at Shark River Inlet.

Publications.—The following publications were issued during the year:

Bulletin 17. Revision of Primary Levels and List of Bench Marks in Northern New Jersey, by C. C. Vermeule, Consulting Engineer.

New editions of the Dover, Plainfield and Shark River Topographic Atlas sheets, scale, 2,000 feet = 1 inch.

New editions of Topographic Atlas sheets Nos. 22, 23 and 26, scale, 1 mile = 1 inch.

Road Map of New Jersey, scale, 4 miles = 1 inch.

Distribution.—The sale of maps for the year, with comparative figures for the two years preceding, are shown in the following table:

	<i>Sheets Sold.</i>		
	1914.	1915.	1916.
Maps on scale of 1 mile per inch,	1,472	1,570	1,685
Maps on scale of 2,000 feet per inch,	1,585	1,195	1,803
Geologic folios,	101	116	115
Geologic map of New Jersey,	253	154	119
County and Municipality map of New Jersey, .....	....	....	344
Railroad map of New Jersey, .....	....	....	158
Road map of New Jersey, .....	....	....	714

Expenditures.—The receipts and expenditures of the Division are included in the figures for the Department, page 14.

TOPOGRAPHY AND ENGINEERING.

Bench marks.—Considerable office work was done in the early part of the year by Mr. Vermeule and his assistants in computing results of the field work which had just been completed, and in the preparation of the manuscript report later published as Bulletin 17 (Geologic Series). In October it was

Fig. 1. Looking Across the Inlet, September, 1915, to the Avon Shore. Remains of the Concrete Piling Undermined by the Current; Old Wooden Jetty at Right.

Fig. 2. Railroad Trestle Built Across the Inlet and a Portion of the 300-foot Temporary Dam of Sheet Piling, Driven to Divert the Current.

found possible to provide funds for a continuation of this work in Mercer and Middlesex counties, and a field party was organized by Mr. Vermeule, Loren P. Plummer, Jr., in charge, and from October 17 to 31 about 48.5 miles of levels had been run and 92 bench marks established. A line was run from Perth Amboy through Hightstown to Bordentown, and a line from Monmouth Junction through Jamesburg to Tennent.

It is the expectation that during the field season of 1917 the United States Coast and Geodetic Survey will coöperate with this Department by extending a line of levels from Sandy Hook southward along the coast.

Shark River Inlet.—As stated in the last annual report, the company having the contract for the construction of jetties there became bankrupt in August, 1915, and after some legal delays the completion of this improvement was taken over by the Department of Conservation and Development under the general supervision of C. C. Vermeule, the Engineer in charge.

Prior to this a considerable portion of the unfinished western end of the north jetty had been undermined by the current running through the inlet, and many of the concrete piles fell over, and were afterward deeply buried in sand when shifting of the inlet diverted the current (Fig. 1). These buried piles lay directly in the line of the westward extension of the jetty, and had to be removed before new piles could be driven. This was one of the difficulties immediately encountered. As soon as the equipment at hand could be supplemented to provide adequately for the effective carrying on of the work, which could not be done until after the first of the year, the south jetty was completed by the addition of the cap and brace beams, and efforts were made to remove the buried piles and extend the north jetty westward from the beach. It was possible to remove some of the piles after dynamiting them, but progress was extremely slow. About February 1 the course of the inlet changed slightly and threatened to undermine the new work, as it had that of the contractor. An attempt to open the inlet on the south side of the jetty by the use of horses and scrapers proved unsuccessful. It was then determined to extend the rail-

road trestle across the inlet to the west side, to bolt waling pieces against the wooden piles of the trestle, and to drive 300 feet or more of wooden sheet piling (Fig. 2) in such manner as first to protect the concrete piling from further scour, and eventually to shut off the inlet; then to open a new inlet in its proper place on the south side of the jetty. This was finally accomplished, although rapid progress could not be made during the winter months owing to weather conditions and ice on the trestles (Fig. 3). As the gap was gradually narrowed the velocity of the current greatly increased. The first effect was to make it impossible to work except at slack tide; a second effect was to scour away the sand which covered the fallen piles so that with the aid of a diver they could be pulled out. These were finally removed, the gap closed, and the new inlet opened across the beach about May 25, 1916. The new inlet increased rapidly in depth and width, and soon became permanently established (Fig. 4). From about June 1 construction work was carried on with increasing rapidity until near the end of September, when the funds available, including a supplemental appropriation of \$25,000, were so far depleted as to compel the Board to consider the discontinuance of all work. At this time there remained to be completed about 251 feet at the west end of the jetty and about 200 feet at the east end. It was possible to continue work during October and to complete the west end of the jetty early in November through the financial aid rendered by the Boroughs of Belmar and Avon.

Physical difficulties have not been the only obstacles which the Department has had to overcome in carrying on this work. The order of the United States District Court, which turned over to it the plant of the bankrupt contractor, contained a stipulation that the question of rental, at a possible maximum of \$500 per month, should be a matter of future adjudication. Immediately after possession was taken the Attorney-General was requested to proceed at once to have this determined, but no progress was made until early in August, when a hearing was held before a special master. After several postponements a second hearing was held in October. At the close of the year

Fig. 3. Ice on the Seaward End of the North Jetty, Showing Conditions Which Retarded Work During the Winter, 1915-1916.

Fig. 4. Inlet After Opening on the South Side of the Avon Jetty. On Completion of the Work the Railroad Track and Trestle Will be Removed.



**Fig. 5. Completed Middle Part of Jetty on the Avon Side, Looking Seaward.
Railroad Trestle Will be Removed.**



**Fig. 6. Sand Fill Accumulated on the North Side of the Avon Jetty; Water
was 6-10 Feet Deep Here When Jetty was Built.**

the matter was still unsettled. The effect of this delay has been to compel the setting aside from the appropriation of a sum sufficiently large to meet this contingent liability. A prompt decision of this question in favor of the Department early in the year would have released this sum, which is urgently needed to complete the work. The results accomplished, however, are substantial (Fig. 5). Of the north jetty there remains to be completed 200 feet at its seaward end. The south jetty is completed, although a further extension seaward might be desirable. The inlet is securely established between these two lines of solid reinforced concrete jetty, and is effectually prevented from migrating up and down the coast as it formerly did. Although still somewhat obstructed by the false work and railroad trestle, the currents of the flood and ebb tide have kept the inlet open, and the small pleasure boats and fishermen's power dories have had sufficient depth and breadth of channel. The Avon beach has built seaward on the north side of the jetty as was expected, so that that side is effectively protected from heavy seas by a wide bank of sand (Fig. 6). There is not the remotest possibility that the sea will ever cut its way through on the north side of the jetty and resume the course it formerly followed before the improvement was commenced.

It is extremely desirable that the work be fully completed as originally planned, and every effort will be made to find ways and means of financing the project.

GEOLOGY.

Mineral statistics.—The customary statistics relating to the mineral industry for 1915 were collected in coöperation with the United States Geological Survey, the results being made known by press bulletins and tabulated statements sent the producers. For the sake of permanent record a summary is given on page 40. This shows that the total value of the mineral products amounted to \$33,364,117, an increase of \$813,519 as compared with the previous year.

Mineral Investigations.—Investigations by Prof. J. Volney Lewis show that the long-forgotten mica deposits of New Jersey

may prove to be a mineral resource of some importance under the present conditions of the mica industry. Twenty-five to fifty years ago, when various attempts were made to work these deposits, the only important use for mica was in stove doors; hence, there was a great demand for large clear sheets, free from spots and stains. Some mica is still used for this purpose, but the chief demand for the mineral to-day comes from the great electrical industries, where it finds many applications as an insulating material. For these purposes clearness and color are of no consequence, and even very small pieces are used in great quantities. Most of the mica now used would have been thrown away a generation ago; and, in fact, many of the old waste heaps in the mica-mining regions of North Carolina and Vermont have been worked over with profit in recent years.

The principal mica deposits that attracted attention years ago in New Jersey are found at two localities in Morris County and two in Warren County. The former are (1) 4 miles west of Morristown, near the Mendham road, and (2) 1 mile south of Mendham; the latter (1) $3\frac{1}{2}$ miles west of Washington and 1 mile north of Broadway, on the south slope of Scotts Mountain, and (2) 6 miles northeast of Phillipsburg and 3 miles north of Stewartsville. In all of these the mica belongs to the variety known as phlogopite, or "amber mica," and it varies in color from gray to clear yellowish-brown. Under the old conditions it was considered inferior on account of its color, and great quantities of small sizes and dark-colored sheets of larger size were dumped in the waste. For all modern electrical uses it is equal in every way to the "white mica" or muscovite, and for some purposes it is even superior. For the thin strips that are used in the commutators of dynamos and motors, for example, phlogopite, or "amber mica," is preferred because it is softer and wears away at the same rate as the metal, thus avoiding the troublesome sparking that occurs when white mica is used.

In prospecting for mica, it must be borne in mind that deposits of this mineral everywhere are notably irregular. In some places a vein several feet thick may be all, or nearly all, mica, while a short distance away the same vein may be filled with

quartz and feldspar and contain little or nothing of value. Even where mica is abundant it is sometimes found so badly crushed and split into such narrow "ribbons" that it is worthless except for grinding. The veins are exceedingly variable also in thickness, a large promising deposit thinning down to a few inches or even "pinching" out altogether in a short distance, perhaps; but this is no indication that the deposit is exhausted, and the experienced mica miner will continue to follow the vein many feet, or even scores of feet, further before abandoning it, and often it is found to widen out to great thickness again.

The average value of sheet mica for the 10-year period preceding 1914 was 18.7 cents per pound, but the prices for the larger sizes of stove mica were considerably higher than this. Scrap mica for grinding averaged \$13.78 per ton. These are values at the mines, and the market prices would, of course, include the additional cost of hauling, freights, etc.

Clay investigations.—During the early part of the year the Department continued the coöperative work in testing New Jersey clays which had been commenced in September, 1915, in coöperation with the State School of Ceramics, under the immediate direction of Dr. C. W. Parmelee and S. M. Sharkey.

A partial report of the results attained was made in the winter at the meeting of the New Jersey Ceramic Society. Later in the year changes in the personnel at the State School of Ceramics, including a change in the Director, delayed the work, but under the new Director, G. H. Brown, the tests are being continued. This work, while, perhaps, not of popular interest, is of great importance to the clay manufacturers and clay producers—an industry the value of whose product in this State is upwards of \$16,000,000 annually.

Clay pits in the region of Woodbridge, N. J., were the first visited; later samples were procured at Fords, Metuchen and Trenton. All pits were located on large-scale maps by a method of subdivided sections.

All strata in each pit were entered in the records from the top downward as A, B, C, etc., and the average thickness of each stratum was recorded. A sample from each layer was

obtained by quartering a 500-pound sample down to about 60 lbs. When the samples arrived at the laboratory each one was given a number by which it was known throughout the work.

Small samples of the first 125 clays were preserved in their original state. The remainder of the samples were ground in the dry pan, passed through a 20-mesh screen, and replaced in the bags.

Small batches of the ground clays were worked up to a plastic condition, aged, hammered into long strips, and cut into tile which were repressed later. About twenty-five tile were made from each batch. Cones for fusion tests were also made, and the fusion point of each clay was determined.

Another larger sample of the ground clay was dried for four hours at 212° – 220° F. A small portion of this was reserved for screen tests, another was mixed with an equal amount of flint and wedged up, and still another was mixed with an equal weight of standard Ottawa sand and worked to a plastic mass. The clay flint mixture was made into cubes for slaking tests, and the clay-sand mixture was made into figure 8 shaped briquets for bonding strength tests. The remainder of the dried samples in each case was used for making the following tests or pieces: (a) Normal consistency and water of plasticity; (b) Slaking cubes; (c) Porosity, shrinkage, and transverse strength bars, 10 cm. long; (d) Figure 8 shaped tensile strength briquets; and, (e) in some instances, warpage bars, 9" long.

The transverse, tensile, and bonding strengths were taken as the mean of 12–15 trials in each case. Drying shrinkage was measured on the transverse strength bars.

The porosity bars, about ten for each clay, were measured for volume and porosity. These bars, along with the tile previously mentioned, were burned to six or seven different temperatures in our large kiln. Porosities, absorptions, volumes, volume changes, color, etc., were determined for each clay at each cone. These operations required 6,500 weighings to hundredths of a gram. Many of the burned tile, which were made for exhibition purposes, have been sent to the clay miners.

The screen tests were made by washing 100 grams of the dried clay through a series of standard screens of 35, 65, 100, 150, and 200 mesh, and determining the percentage of material remaining on each screen. A microscopic examination of the residues was made, and the minerals present were recorded in each instance. The tile were made for exhibition purposes for the miners; they show color, density, vitrification, etc., at the different burning temperatures. They are of great use to the miner for reference and in the sale of clays. The fusion points measured, of course, the refractoriness of the clays. The normal consistency of water of plasticity indicate roughly the plasticity and workability of the clay. The slaking tests give a relative idea of tightness and set in the dry state. The tensile, bonding, and transverse tests give an idea of the plasticity, and reveal the strength or lack of strength in the dry condition. The warpage tests make possible comparative estimates of load-carrying capacities at high temperatures. The screen tests show the percentage of material that remains on each standard screen, the total residue coarser than 200 mesh, and the minerals present. The dry, soaked, and suspended weights make it possible to calculate the volume change, burning shrinkage, porosity, absorption, etc., at each temperature. Thus the vitrification range is determined. The burning colors are recorded according to some scale. These data tell the best use to which the clays may be put, *i. e.*, to make tile, fire brick, face brick, terra cotta, saggars, etc. All the work has been completed on the first 125 clays from the Woodbridge district. In addition, tile and cones have been made from fifty clays from the neighborhood of Fords and Metuchen and from seventeen clays from around Trenton. These are now being burned at six different temperatures.

As a result of this work, a New Jersey clay is now being used in the manufacture of lead pencils. Up to the time of the war German clays were used for this purpose. At the present time mixtures of New Jersey clays are being made with a view to their being used as a substitute for the German Klingenberg clay, which until recently was imported in large quantities for

use in the manufacture of graphite crucibles. Numerous inquiries, both from within and without the State, in regard to where clays suitable for certain purposes may be found in New Jersey, come to the Department and to the School of Ceramics. Under this coöperative agreement they are answered by the School of Ceramics. By consulting data and trial pieces secured in connection with this investigation it has been possible to select clays having properties suitable for the purpose desired.

Particular instances of this have occurred, and clays suitable for the manufacture of saggars have been recommended to dealers and users of sagger clays. Clays also suitable for the manufacture of abrasive wheels have been recommended to manufacturers of these products.

The samples of burned tile which have been submitted to the miner of each clay have been of value in classifying clays according to the uses for which they are best adapted. By consulting his trials, the miner has been enabled to state what the color and general behavior of his clay will be when burned to a certain cone.

In the final compilation of the data, it is hoped that it will be possible to establish some classification of New Jersey clays in accordance with their properties.

Reported oil discoveries.—Late in October the discovery of oil in a well three miles east of Millville was announced in the newspapers. Geologists of the Department were aware of this boring, and earlier in the year had visited the locality. R. B. Gage, Chemist of the Department, made an immediate investigation and obtained a sample of oil said to have been taken from the well. At the time of his visit operations were at a standstill. There was some oil in the pipe, but it was not possible to determine the quantity. Two weeks later another visit was made by the State Geologist and E. W. Shaw, of the U. S. Geological Survey. Operations were still suspended and the lower end of the pipe was reported blocked. No effort had been made to pump the well, and the only oil obtained had been a relatively small amount baled out and distributed as samples. Information was not obtainable regarding the depth of the well

or the sequence of strata penetrated, although these were promised later. No signs of oil or of oil-bearing strata were noted in the "slush" piles at this or the previous visit.

The sample of oil furnished was analyzed by the Chemist of the Department with the following results:

Analysis of Sample of Millville Oil.

Specific Gravity at 60° F.,	0.85 or 35° Be.
Flash Point,	58° C.
Fire Point,	73° C.
Distillate, 1 to 150° C.,	0.4%
" 150 to 300° C.,	55.2%
" 300 to 315° C.,	14.38%
Residue, about,	30.0%
Solubility in ether,	100.0%

It contains little or no gasoline and very little kerosene, but it is rich in lubricating oils. On distillation at 315° C, there was evidently some chemical change, due probably to the breaking up of some constituent, and a strong pungent odor was given off, which is not unlike some grades of fish oil. The residue after distillation is fairly thick, quite full of paraffine and is completely soluble in ether.

In view of the public interest aroused, it seems proper that a statement be made by the State Geologist regarding the probability of the occurrence of oil in southern New Jersey in commercial quantities, and, if so, whether there are any means other than boring by which oil-bearing territory can be located.

It is to be noted, first, that the strata are of an age similar to oil-bearing strata elsewhere; that they contain some carbonaceous matter which is needful as a source for petroleum; and that they have suffered no intense deformation or metamorphism. In so far as these considerations have weight, they are in favor of the view that oil may exist in commercial quantities. There are, however, considerations on the other side. Carbonaceous matter, although present in the strata, is relatively scarce, in fact, is much less abundant than in producing fields; the relative sandiness and great porosity of the coastal plain sediments underlying New Jersey are more favorable for the escape

of oil as fast as formed rather than for its confinement and accumulation; the general occurrence of fresh water everywhere in the coastal plain sediments of the State and the absence of salt water in these deposits, except in a very few wells close to the ocean, point to a free circulation through these beds which would prevent the accumulation of oil in pools; moreover, in none of the many deep wells drilled for water in the coastal plain, to a depth in one instance of 2,300 feet, has any sign of oil been found. This is true even for the wells nearest to Millville.

In some regions the occurrence of oil is indicated by oil-seeps, the outcrop of oil-bearing shales, or the occurrence of bitumen in the rocks. No instance of oil seepage and no oil-bearing shales have ever been observed by any worker on the State Geological Survey. Since the Survey has been continuously active since 1864, and the geology of the State has been studied to a more minute degree than that of any other State, the conclusion seems irresistible that they do not occur.¹ The iridescent iron scum sometimes formed on water has often been mistaken for oil by the unskilled, but it can be differentiated by its taste and odor. Bitumens are reported in minute quantities, but not in conditions suggestive of oil.

The magnetic needle has long been employed to locate beds of magnetic iron ore. The witch hazel or peach twig wand has for many years enjoyed an ill-deserved reputation among the ignorant and credulous as a means of finding water, and occasionally there have been individuals who have claimed to locate oil by some special instrument. It should, however, be hardly necessary to state that no instrument is known to oil operators, to mining engineers or to geologists by which the occurrence and location of oil in the earth can be detected in advance of boring.

With very few exceptions, the commercial oil fields are marked by certain characteristic structural features of which arches and domes are most common. Within the limits of these structures

¹ Since writing the above the State Geologist has been advised by T. G. Clapp that he had observed occasional bubbles of a very light oil rising in a spring in Ocean county.

oil is found, beyond them wells are dry. The entire southern part of New Jersey is underlain by a series of alternating beds of sand, clay and gravel, with some layers of greensand marl. In exposures these appear horizontal, but a comparison of sections shows that they have a gentle dip or slant downward to the southeast. This is forty feet or more per mile for the basal beds and ten or fifteen feet per mile for the upper members of the series. Folds, arches or dome structure, common in nearly all commercial oil fields, are not known to exist. If any structure favorable to the accumulation of oil is present in the Millville region or elsewhere in southern New Jersey, it is not manifest upon the surface, and there are no surface means by which its extent or direction can be determined. Since no characteristic oil structures are known and no surface indications of oil have been found here, there are no means known to geologists by which the extent of an oil field can be determined except by actual drilling.

In view of the above facts the State Geologist and his associates have reached the conclusion that it is unlikely that an oil pool of commercial importance exists in the State. If their conclusions are well founded, all drilling for oil in this State is yet speculative and should be undertaken only by those who fully understand the hazards of the game and can afford to lose their entire venture.

SOIL SURVEY.

The study and mapping of the soils of the State was continued throughout the year in coöperation with the United States Bureau of Soils at Washington, D. C., and the State Agricultural Experiment Station at New Brunswick. Five men have been engaged in this work for varying periods, Austin L. Patrick and J. M. Snyder, representing the United States Bureau of Soils, and C. C. Engle, L. L. Lee and H. A. Miller, the Department of Conservation and Development. The State Agricultural Experiment Station contributed \$500 to the expense of the field work, besides carrying on collateral soil studies, chiefly the analysis of soil samples.

On November 1, 1915, Mr. Engle and Mr. Patrick began field work in the vicinity of Millville, in the area covered by atlas sheet 35, and continued until inclement weather set in, about the middle of December. Mr. Patrick was then transferred to the South, and Mr. Engle spent the winter months compiling the results of the previous season's work in the Camden area, collecting samples of marl for analysis by the Experiment Station, and assisting in the mechanical analysis of the soils. Work in the Millville region was resumed by Mr. Engle about the first of May, and by Mr. Patrick on May 27. On June 12 the party began work at Belvidere, Warren County, since much better progress could be made during the hot summer months in an area in the northern part of the State. On June 20 J. M. Snyder and H. A. Miller entered the field, and on July 1 they were joined by L. L. Lee. The work in Warren and Hunterdon counties (atlas sheet 24) was pushed energetically until October 7, during which period approximately 500 square miles were mapped, leaving in this area only 136 square miles to be completed next season. Mr. Miller's employment having been for the summer vacation only, he left the party September 15th. On October 7 field work in the Millville area was again taken up to be continued for the balance of the season. To October 31, the end of the fiscal year, 294 square miles had been mapped in the Millville area, making a total of 794 square miles surveyed during the year in the two areas. -

In addition to the field work, the manuscript and maps covering the Camden area, surveyed during the previous year, were completed and the report forwarded to the Bureau of Soils in Washington for publication. Arrangements have been made with the Public Printer for the purchase of a small edition of this report for distribution by the Department of Conservation and Development. This will be in addition to the much larger edition to be published and distributed by the United States Bureau of Soils itself and through the Congressmen in whose district the area lies.

During the year the soil report and map on the Freehold area which embraces the northern part of Monmouth County was

published by the Bureau of Soils. This covered the coöperative field work done in previous years. A limited number of copies of this report can be obtained of the State Geologist upon request.

• TESTING LABORATORY.

Work Done.—The work done has been much the same as in previous years. It is chiefly the testing of road materials and pavement samples of various types, undertaken at the request of the Commissioner of Public Roads.

During the past year over 150 samples of oil and asphalt, 100 pavement samples, between 80 and 90 pavement aggregates and nearly 100 minerals and rocks have been tested or analysed. During the latter months of the year the number of samples sent for testing was so far in excess of the capacity of the laboratory that it will take until the middle of next February to complete the work on materials now on hand. It has been impossible to take up work on certain classes of materials, although existing road specifications require that these be subject to test. This condition cannot be remedied until a new laboratory building is built and equipped. Until that is done the most important lines of work must be selected and the others left undone.

New Building.—As stated in the report for last year, the appropriation for a new building was inadequate, and work could not be started, although a lot had been purchased. In April the Legislature reappropriated a sum of \$23,500, deemed at that time to be sufficient to build and equip a building at prices then prevailing. Inasmuch as the item was not available for use until November 1, 1916, the beginning of the present fiscal year, no steps could legally be taken in preparation of plans and specifications in advance of that date.

The rapid rise since last year in the price of all materials, and in particular, in some classes of equipment, which will be necessary, may cause further delay if the lowest bids should again exceed the appropriation.

The importance of the early completion of a new building is the greater in that this laboratory has been designated by the State House Commission as one of the laboratories "for the

execution of such functions as may hereafter be required" by this Commission, as provided by Section 7 of the (State Purchasing) act.

In view of a very considerable increase in the amount and diversity of work which will certainly be demanded in the near future, the importance of early completion of the new building cannot be overestimated.

ARCHAEOLOGY.

During the early part of the year Mr. Max Schrabisch was occupied in completing the report on his surveys in Warren and Hunterdon counties. The manuscript was not received until late in the winter, and time has not yet been found for the necessary editorial work. No new field work was undertaken during the past summer.

The subject of traces of man in the sand and gravel along the Delaware River at Trenton has first and last received much attention from archæologists and geologists. During the past year or two further studies have been carried on under the direction of the American Museum of Natural History. The material discovered in this investigation was examined by Prof. J. Volney Lewis to determine its lithologic character and probable source.

STATE MUSEUM.

In the report for last year the necessity of a thorough reorganization of the State Museum was emphasized. In reaching a final decision as to the plan to be adopted the Board was greatly influenced by the experience of the Newark Museum and the counsels of its Director, Mr. J. C. Dana, and of Miss Louise Connolly, whose success in harmonizing museum and school work has been marked. It was, however, easier to formulate a plan of reorganization than to find the right person to carry it out. Finally, through the coöperation of Mr. Dana, Miss Helen C. Perry, of the Newark Museum staff, was engaged and began work June 1. In the following paragraphs Miss Perry sets forth the results already accomplished and her plans for the future:

"The State Museum is being reorganized on an educational basis, with two main objects in view: the one, to make it attractive and useful to the community; the other, to make its collections available for educational purposes throughout the State.

"Most of the summer has been spent in laying the foundations for carrying out these two plans. The Museum rooms have been redecorated, the cases remodeled, much old equipment discarded, and some new added. The collections of natural history specimens have been carefully gone over, cleaned, catalogued, and stored where they are easily accessible. The duplicates, of which there were a great number, have been made up into school-lending sets. The other collections have been catalogued and stored, made up into lending sets, or rearranged for exhibition purposes. Much new material has been added, especially industrial process exhibits typical of the State. A number of the leading manufacturers of Trenton and other parts of the State have already given the Museum such exhibits and others are promised.

"No one of the collections, either of natural history, geology, forestry or industry can be shown in its entirety, because of lack of space, but special exhibits, representative of the various collections, will be put up and changed from time to time. In this way the Museum will be constantly showing exhibits of fresh interest. The displays will be popular in style, with simple, untechnical labels. Instead of synoptical collections of birds, for instance, there will be cases showing bird-houses, how birds get their food, birds to be seen during the winter months, etc. But there will be a complete reference set of New Jersey birds available to students for special study. The industrial exhibits will include materials, steps in the process of manufacture, and the finished products, with pictures and labels to complete the story. The other collections will be shown in the same popular style.

"The Museum hopes to be particularly useful to the schools of the State. For the schools outside of the city, a circulating library of teaching materials, including lantern slides, natural history specimens, industrial process charts, minerals, woods,

etc., is being established. These lending collections are all to be arranged in standard sizes to fit the school-lending cases, of which about seventy are being sent out. A teacher may order certain charts or specimens, keep them a few weeks or months, and exchange them for others. There are, of course, only duplicates of Museum materials.

"Within the city the Museum can do even more for the schools. A teacher may telephone that she wishes to teach a lesson on fossils, game birds or pottery, and the specimens will be laid out on a large work table, or in special show-cases, where the class may come to study them. By special arrangement later on appointments can be made by any group for lantern-slide lectures in the Museum.

"In return for these privileges the schools will help the Museum (a number have already volunteered) by arranging insect life histories, preparing industrial process charts of local industries, collecting fresh wild flowers for the spring wild-flower exhibit, making picture collections, sending in natural history specimens of all kinds, and in countless other ways that will naturally develop.

"There will be special exhibits of various phases of education from time to time, which will be shown first in Trenton, and then sent as traveling exhibits to other centers.

"Later on, if there is a demand for it, classes in docentry may be formed, consisting of teachers, normal students, club women and others who may volunteer to help out the Museum staff in giving lectures on exhibits or lantern slides to groups of school children, shop employees, clubs, or other groups.

"The reorganized Museum, then, will be a large, light room, with uncrowded, carefully arranged and labeled exhibits, and a big reading and work table. There will be rugs and tapestries and bright pieces of pottery (all Jersey made) to make it attractive to the visitor. For the students there will be books and access to complete synoptical reference collections; for the teacher within the city the privilege of bringing her classes and using the Museum as a laboratory; for the teacher outside the city the lending sets which she may have upon application;

for the nature lover an opportunity for a more intimate knowledge of nature; for the laborer a vision of the meaning of the work of his hands; and for the sightseer some conception of the resources of the State of New Jersey.

"Of course, this plan will of necessity take time to work out, but with teacher, pupil, manufacturer, laborer, and the general public all helping with work, interest, and gifts, the Museum will soon become what it should be—a thoroughly live institution of State-wide usefulness."

WATER RESOURCES.

Work of State Water-Supply Commission.—As indicated above, on July first the Board of Conservation and Development took over that part of the work of the State Water Supply Commission which was not affected by Chapters 70 and 71, P. L. of 1916. The first of these laws divided the State into two water-supply districts, and the second provided for the appointment of District Water-Supply Commissioners and defined their powers and duties.

So far as can be made out from a study of the records, the following are the more important actions of the former Commission up to July 1, 1916.

Shark River Water Company.—The application received September 8, 1915, from the Shark River Water Company to divert water from Shark River to sell at wholesale was heard at Belmar on October 22, 1915. Written protests opposing the application were received from the Mayor of Belmar and from Asbury Park. On November 16, 1915, the application was taken up by the full board and the Engineer, and was rejected on the grounds that the applicant had failed to show sufficient public necessity for such diversion. A later application by the same company, made under date of February 1, 1916, was withdrawn on April 25, 1916.

Peoples Water Company.—The Peoples Water Company, on the fifth day of November, 1915, made application to the State Water-Supply Commission for approval of its plan to supply the Township of Raritan, in the County of Monmouth, with

water for public and private use from not exceeding five (5) artesian wells, not to exceed ten inches in diameter, to be driven on property to be occupied by said Company, and consisting of the westerly half of Block R, as shown on a map known as "Map of West Keansburg Beach, Keansburg, Monmouth County, New Jersey," a public hearing was held upon said application in the School House at Keansburg, Monmouth County, New Jersey, at 2 o'clock P. M. on Saturday, December 18, 1915, at which time and place there was opportunity for all persons and municipalities affected by the proposed plans to be heard for or against the granting of the application. On January 4, 1916, the application was approved subject to the following conditions:

1. This approval is given for a period of thirty years, with the right of renewal at the expiration thereof for twenty additional years from the date of this consent, subject to such annual charge by the State as now or may be hereafter authorized by law.

2. This grant shall not be construed to empower or permit the Company, its successors or assigns, to use any of the waters mentioned in this petition for which it shall not have first obtained approval as to quality of such water by the State Board of Health.

3. Upon action of the municipality authorized in this consent to be furnished with water from the source applied for and hereby granted, or upon such action by any other municipalities which may hereafter be supplied therefrom, and upon one year's notice in writing served upon the said Peoples Water Company, should said municipality, or municipalities, acquire the water plant of the Peoples Water Company no additional value shall be included in any payment for such plant for diversion rights as against the State during any period covered by this grant, but the acquisition of such plant shall otherwise be subject to such terms and conditions as may now be a part of any grant or franchise given by the said municipalities to the Peoples Water Company.

4. The said Peoples Water Company shall in good faith begin the construction of the works mentioned in its application within six months from the date of this assent, completing the same within one year thereafter.

5. This assent shall not become operative unless said Company shall have filed with this Commission its agreement in writing to accept the terms and conditions hereby imposed within ninety days from the date hereof.

6. Upon condition that at any time hereafter any municipality to be supplied shall purchase or acquire the property or works of the Company, or that portion thereof supplying such municipality with water, this grant shall be in perpetuity as regards such portion so acquired, or so long as such municipality shall own such property, without payment for diversion rights as against the State, except such as may now or hereafter be imposed by law. If such

municipality shall at any time after purchase abandon this source of supply all rights hereby granted shall revert to the State, nor shall the rights hereby granted be assigned or set over to any corporation or person without first obtaining the consent of this Commission.

Formal acceptance of the terms and conditions imposed were filed with the Commission on March 3, 1916.

Island Heights.—On March 7, 1916, the State Water-Supply Commission adopted the following resolution:

"WHEREAS, The Borough of Island Heights, on the ninth day of December, 1915, made an application for permission to construct a new water-supply plant in accordance with plans and specifications filed with the Commission; and

"WHEREAS, The Commission held a hearing in accordance with the provisions of the law, and testimony was taken for and against the granting of said application; and

"WHEREAS, On March seventh, the subjoined letter was received from the Borough of Island Heights, and concurred in by counsel for the Island Heights Water, Power, Gas and Sewer Company, requesting permission to withdraw the pending application because the said Borough of Island Heights had entered into an agreement to purchase the plant of the Island Heights Water, Power, Gas and Sewer Company.

Therefore, be it resolved, That the pending application of the Borough of Island Heights for consent to construct a new water plant be and hereby is denied, and the Secretary be instructed to send a copy of this resolution to the Attorneys for the Borough of Island Heights, and to the Counsel for the Island Heights Water, Power, Gas and Sewer Company."

"February 28, 1916.

State Water-Supply Commission, State House, Trenton, N. J.:

GENTLEMEN—The Borough of Island Heights and the Island Heights Water, Power, Gas and Sewer Company have agreed upon a price for the sale by the Company to the Borough of its water plant and system. In view of this fact the Borough of Island Heights hereby withdraws its petition for permission to construct a water plant and system, which petition was filed on or about the 7th day of December, 1915.

Yours truly,

WILFRED B. WOLCOTT,
Borough Solicitor."

Linden Water Company.—On May 2, 1916, the Linden Water Company made application for permission to divert water from the Rahway River to supply the Township of Linden. A hearing was advertised and postponed, and later when it became apparent that the application could not be finally acted upon

before June 30, the date on which the powers of the State Water-Supply Commission expired, consent was given to its withdrawal.

Dams.—During the year the Ocean County Electric Company submitted plans for a dam at Toms River, which were approved. The plans submitted by the Butler Water Company for an intake reservoir dam on Apshawa Creek were approved on April 4, 1916, after modification to meet the views of the Consulting Engineer of the Commission.

Excess diversion charges.—On June 27, 1916, the Commission adopted the following resolution in regard to the charges for excess water diversion, which had been levied against the East Jersey Water Company.

"WHEREAS, Acting upon the advice of the Attorney-General, the State Water-Supply Commission did not certify to the State Comptroller for collection of the excess diversion charges against the East Jersey Water Company for the years 1908-9-10-11-12-13-14 and 15, in accordance with the provisions of Chapter 252, P. L. 1907, for the reason that the Commission did not admit the right of the said Company to divert water from the Passaic River, which question was in process of litigation during that period, and the Commission was advised that such excess diversion assessment if actually certified to the Comptroller for collection might be deemed a license for the diversion of water to the prejudice of the pending litigation; and

"WHEREAS, The said litigation having been concluded by final Court decision in 1915, upon the advice of the Attorney General, on February 7, 1916, the Commission certified to the State Comptroller for collection accrued assessments for excess diversion for the several years above mentioned to the total amount of \$6,362.08, and the East Jersey Water Company having demanded a hearing upon the question as authorized by law, which was held in the office of the Commission in the State House at Trenton, at which hearing testimony was taken and brief submitted by Counsel for the said Water Company, with the result that the Attorney-General filed a written opinion bearing date June 12, 1916, advising the Commission that the total amount of \$6,362.08 so certified to the State Comptroller was illegally assessed, and that the collection of these charges for excess diversion under the present law is doubtful, and too uncertain to justify a suit for the recovery of the same; therefore, be it

Resolved, That the excess diversion charges against the East Jersey Water Company for the years 1908-1909-1910-1911-1912-1913-1914 and 1915 amounting in total to \$6,362.08 be and hereby are cancelled; and be it further

Resolved, That this resolution be spread upon the minutes and copies of the same be transmitted to the State Comptroller and to the Counsel for the East Jersey Water Company."

Extensions of time.—On June 27, 1916, an extension of one year from June 16, 1916, was granted to Witherbee, Sherman & Co. for the completion of its proposed plant in Middlesex County. Extension of three months from July 4, 1916, was granted to the Peoples Water Company for beginning work at Keansburg, Monmouth County.

In July the Board of Conservation and Development approved the following application:

New Egypt Light, Heat, Power and Water Company.—The New Egypt Light, Heat, Power and Water Company, on May 17, 1916, filed a petition for permission to divert water from Crosswicks Creek for an additional supply for use in case of fire. A public hearing upon the application was held in the State House at Trenton, on August 2, 1916, at which all persons desiring to be heard for or against the approval of the application were heard. On the same date the application was approved subject to the following terms and conditions:

1. This approval is given for a period of thirty years, with the right of renewal at the expiration thereof for twenty additional years, subject to such annual charge by the State as is now or may be hereafter authorized by law.
2. This approval is limited to the diversion of water for fire purposes only in emergencies when the present supply from the artesian well is inadequate.
3. The said New Egypt Light, Heat, Power and Water Company shall in good faith begin the construction of the works mentioned in its application within six months from the date of this approval and shall complete the same within one year.
4. This approval shall not become operative unless said company shall have filed with this Board within ninety days from the date hereof its written agreement accepting the terms and conditions hereby imposed.

Formal acceptance of the terms and conditions imposed was filed with the Board on October 31, 1916.

Pending applications.—At the close of the year there were also before the Board the following applications on which hearings had either been ordered or held:

The Linden Water Company, to divert water from Rahway River for the supply of Linden Township, on which hearings had been held on October 4 and 18;

The North Jersey District Water-Supply Commission in behalf of the cities of Newark and Paterson, to divert 50,000,000 gallons per diem from a storage reservoir to be constructed on the Wanaque River at or near Midvale;

The West Monmouth Water Company, to divert ground water from wells to supply the Borough of Farmingdale;

The West Monmouth Water Company, to divert ground water from wells to supply the Borough of Englishtown.

Other matters.—The Peoples Water Company of Keansburg has been granted an extension of time for beginning work from October 4, 1916, to April 1, 1917.

The Assistant Engineer has at intervals inspected the construction of the Apsawa dam and reported thereon.

On August 15, 1916, the following petition was received from the Township Committee of North Plainfield:

"We hereby present a request to you to investigate and take action upon the dam and retaining wall at Seeley's Mills, located in North Plainfield Township, near Scotch Plains, said dam, owing to the recent freshet, being in an unsafe condition, and roads and property are in danger of damage.

This request is in accordance with a resolution passed by the Township Committee of North Plainfield Township at its regular meeting on August 10.

We would request that prompt action be taken in this matter, as the main road has been completely undermined by the waters flowing over this dam, and is now blocked off completely for traffic.

Very truly yours,

(Signed) WILLIAM DELAROCHE ANDERSON,
Chairman, Township Committee."

An inspection of the dam was made both by the Assistant Engineer and the State Geologist, and the petitioners and owners were notified that the Board would hear the matter on September 6, 1916. On that date, no one appearing on either side, the petition was by unanimous vote laid on the table.

Ground Waters.—The State Geologist is in frequent receipt of requests for information regarding the occurrence of ground water and the depths at which water-bearing strata may be found. Replies are always made and the questions answered in such detail as the facts at hand warrant. All available well records are tabulated for reference and well drillers and others are urged to furnish the department with such information.

PUBLICATIONS.

The various reports of the State Geologist contain a vast amount of information relative to the natural resources of New Jersey. From its nature much of this is of permanent value, entirely independent of its date of publication. Copies of most of the reports published since 1884 are available for distribution, without cost except that of transportation, to persons who have good reason for receiving them. *When the stock on hand of any report is reduced to 200 copies, the remaining volumes are withdrawn from free distribution and are sold at cost price.*

The Geological Survey has published two sets of topographical maps of the State, one on a scale of one mile per inch and the other 2,000 feet per inch. These are sold at 25 cents per sheet. It has also issued several maps of the entire State on a single sheet, at prices varying from 35 to 50 cents. In co-operation with the United States Geological Survey, it is also publishing a Geologic Atlas of New Jersey, to be issued in several parts, each folio containing topographic and geologic maps, illustrations and descriptive text. Five of these folios have been issued, and are sold for 25 and 50 cents, according to size.

Special circulars have been prepared describing these publications, which will be sent on application. All requests for reports or information regarding the same should be addressed *State Geologist*, Trenton, N. J.

APPENDIX.

Statistics of the Mineral Industry of New Jersey for 1915.

As heretofore, these statistics were collected and compiled in coöperation with the United States Geological Survey. The tabulated results with summary statements were made public through the newspapers as early in the year as possible, and were sent to the producers. As a matter of permanent record and for future reference they are here made a part of the State Geologist's report. In order to avoid revealing individual production it has been necessary in some cases to group together several industries or classes of products which have no logical connection.

Total Value of Mineral Industries in New Jersey During 1915.

<i>Product.</i>	<i>Number of Producers.</i>	<i>Value in 1915.</i>	<i>Value in 1914.</i>	<i>Increase or Decrease.</i> ¹
Clay and clay products,	198	\$16,583,322	\$17,133,236	\$549,914 D
Stone,	79	1,612,061	1,547,773	64,288 I
Portland cement,	3	1,607,706	3,081,205	1,473,499 D
Sand and gravel,	82	1,447,557	1,544,322	96,765 D
Iron,	3	1,140,400	1,076,208	64,192 I
Mineral water,	13	116,226	155,649	39,423 D
Lime,	10	35,393	41,226	5,833 D
Other products, ¹	13	10,821,452	7,970,979	2,850,473 I
Total,	401	\$33,364,117	\$32,550,598	\$813,519 I

ZINC ORE.

The great demand for spelter during 1915 resulted in a great increase in the production of zinc ore at the mines of the New Jersey Zinc Company. At the Franklin mine 742,379 tons of

¹ Includes zinc ore, mineral paint, coke and by-products, sand-lime brick, and greensand marl, which are here grouped together to conceal the production of individual producers.

ore were hoisted, while at the Ogdensburg mine, in connection with the development work there, 3,459 tons were raised, a total of 745,838 tons. This represents an increase of 256,608 tons over the production for 1914.

The total amount of ore shipped from the mines during the year was 623,822 tons. Its value is included in making up the total of the mineral production for the State.

Zinc Ore Mined in New Jersey Since 1880.

Previously reported,	6,701,355 short tons
Mined in 1915,	745,838 short tons
Total,	7,447,193 short tons

IRON ORE.

Three companies engaged in iron mining during 1915, operating five groups of mines: The Empire Steel and Iron Company operating the Mount Hope group, the Allen mine, and the Oxford group, the Thomas Iron Company operating the Richard mine, and the Ringwood Company working the Peters mine. The production was 415,234 long tons, an increase of 65,099 long tons; 391,115 long tons were marketed at a value of \$1,140,400, an increase in quantity of 44,295 long tons and in value of \$64,192. The stock on hand at the mines at the close of the year was 178,284 long tons. All of the ore was magnetic.

Total Iron Ore Mined in New Jersey Since 1870.

Previously reported,	20,490,407 long tons
Mined in 1915,	415,234
Total,	20,905,641 long tons

CLAY AND CLAY WORKING INDUSTRY.

The production for 1915 is the lowest reported since 1908, there being a decrease of nearly one-half a million dollars from the figures of 1914. Details are given in the following table:

Production of Clay and Clay Products in New Jersey, 1915.

	<i>Value</i> 1915.	<i>Value</i> 1914.	<i>Increase or Decrease.</i>
Clay (mined and sold raw),	\$617,904	\$648,584	\$30,680 D
Clay-Products:			
Pottery,	8,049,338	8,131,356	82,018 D
Brick and Tile,	7,916,080	8,353,296	437,216 D
Total,	\$16,583,322	\$17,133,236	\$549,914 D

Clay.—The following table shows the amount and value of the clay mined and sold raw. It does not include the value of the clay mined by any manufacturer.

Clay Mined and Sold Raw, 1915.

<i>Varieties.</i>	<i>Number of Producers.</i>	<i>Amount in Short Tons.</i>	<i>Value</i> 1915.	<i>Value</i> 1914.	<i>Increase or Decrease.</i>
Ball clay,	7	8,369	\$27,879	\$13,341	\$14,538 I
Fire clay, including sagger clay,	36	227,813	412,353	485,599	73,246 D
Stoneware clay,	10	12,871	28,706	25,532	3,174 I
Brick clay,	6	19,886	35,808	24,229	11,379 I
Miscellaneous,	14	71,787	113,158	99,883	13,275 I
Total,	45	340,726	\$617,904	\$648,584	30,680 D

Pottery.—Details in regard to the production of pottery are given in the following tables:

Pottery Production of New Jersey, by Varieties, 1915.

<i>Varieties.</i>	<i>No. of Producers Reporting.</i>	<i>Value</i> 1915.	<i>Value</i> 1914.	<i>Increase or Decrease.</i>
Red earthenware,	6	\$34,600	\$35,198	\$598 D
Stone ware and yellow or Rockingham ware,	3	91,815	72,288	19,527 I
White ware, including C. C. ware, white granite, semi-porcelain ware and semi- vitreous porcelain ware,	8	665,633	727,637	62,004 D
China, bone china, delft and belleek ware,	7	983,855	1,076,043	92,188 D
Sanitary ware,	20	4,793,406	5,058,204	264,798 D
Porcelain electrical supplies,	13	1,028,992	905,878	123,114 I
Miscellaneous,	11	451,037	256,108	194,929 I
Total,	54	\$8,049,338	\$8,131,356	\$82,018 D

Pottery Production In New Jersey, by Counties, 1915.

Rank in 1915.	Counties.	No. of Producers Reporting.	Value 1915.	Value 1914.	Increase or Decrease.
1	Mercer,	34	\$6,632,730	\$7,101,197	\$468,467 D
2	Middlesex,	5	732,791	418,035	314,756 I
3	Hunterdon,	3	288,989	227,568	61,421 I
	All other counties,	12	394,828	384,556	10,272 I
Total,		54	\$8,049,338	\$8,131,356	\$82,018 D

More than 60 per cent. of the sanitary ware made in the United States is made in New Jersey. New Jersey also ranks first in china ware, producing 42 per cent. of the output for the United States, and is third in porcelain, electrical supplies and in white ware. Considering the pottery products as a whole, New Jersey stands second among the States, Ohio being first.

Brick and Tile.—The brick and tile production suffered from the general depression in building trades which prevailed through so much of the year 1915, and nearly all lines showed decreases.

Production of Brick and Tile In New Jersey, 1915.

	No. of Producers.	Production in Thou- sands.	Value 1915.	Value 1914.	Increase or Decrease.
Common brick,	50	354,104	\$2,099,654	\$1,944,806	\$154,848 I
Front brick,	10	25,698	375,431	377,779	2,348 D
Fancy brick,	4	.....	409,488	463,221	53,733 D
Enameled brick,					
Fire brick,	12	36,403	899,613	897,442	2,171 I
Total brick,	64	.....	\$3,784,186	\$3,683,248	\$100,938 I
Drain tile,	8	.....	\$41,331	\$31,043	\$10,288 I
Architectural terra cotta, ...	6	.....	1,430,968	1,620,791	189,823 D
Fireproofing and hollow blocks,	11	.....	1,389,120	1,599,295	210,175 D
Tile (other than drain tile),...	15	.....	995,097	1,139,895	144,798 D
Miscellaneous,	11	.....	275,378	279,024	3,646 D
Total tile, etc.,	46	.....	\$4,131,894	\$4,670,048	\$538,154 D
Total brick and tile, ..	99	.....	\$7,916,080	\$8,353,296	\$437,216 D

In the above production, Middlesex County was first, \$5,653,398, or 71 per cent. of the total; Mercer County second, \$403,533; Monmouth third, \$380,563, and Camden fourth, \$321,983.

The rank of New Jersey among the States in various lines of the clay industry was, for 1915, as follows:

First in Sanitary Ware, China Ware, Art, Tile, Enameled Brick and Clay (mined and sold as Clay).

Second in Fireproofing, Floor Tile, Wall Tile, Terra Cotta, and in Total Pottery Products.

Third in Porcelain Electrical Supplies, White Ware, and in Total Clay Products.

Fourth in Front Brick, and in Total Brick and Tile Products.

Fifth in Common Brick and Fire Brick.

PORTLAND CEMENT.

The year 1915 was one of extreme depression in the Portland cement industry. One of the plants located in New Jersey was shut down, and the output of the other two was much curtailed. Not only were production and shipments less, but prices per barrel at the mill were lower.

Production was 1,579,173 barrels, a decrease of 2,059,627 barrels; shipments were 1,977,474 barrels by three companies valued at \$1,473,499, a decrease of 1,553,002 barrels in quantity and \$1,607,704 in value from the year before. The prices for 1915 averaged \$0.745 per barrel as against \$0.873 in 1914. Since shipments exceeded production, the stock on hand at the mills at the close of the year was less than in 1914, being only 164,341 barrels. With the growth of the cement industry in other parts of the country, New Jersey's rank among the States is now twelfth.

STONE.

The stone industry is limited to the northern part of the State, and is chiefly in crushed rock for road metal, concrete and railroad ballast. Details are shown in the following series of tables:

Production of Stone in New Jersey, by Varieties, 1915.

	Value 1915.	Value 1914.	Increase or Decrease.	Per Cent. of Total, 1915.
Trap,	\$1,281,545	\$1,164,529	\$117,016 I	79.5
Limestone,	159,549	240,937	81,388 D	9.9
Granite,	95,986	74,808	21,178 I	5.95
Sandstone,	63,964	53,394	10,570 I	3.97
Slate,	11,017	14,105	3,088 D	.68
Talc and serpentine,				
Total,	\$1,612,061	\$1,547,773	\$64,288 I	100.00

Production of Stone in New Jersey, by Uses, 1915.

<i>Use.</i>	<i>Value 1915.</i>	<i>Value 1914.</i>	<i>Per Cent. 1915.</i>	<i>Per Cent. 1914.</i>
Crushed stone,	\$1,380,266	\$1,215,708	85.62	78.55
Road metal,	(822,214)			
Railroad ballast,	(260,426)			
Concrete,	(297,626)			
Blast furnace flux,	141,915	136,038	8.80	8.79
Building stone (rough and dressed) and monuments,	49,911	48,344	3.10	3.12
Paving, ¹	18,033	11,645	1.12	.75
Other uses, ¹	21,936	136,038	1.36	8.79
Total,	\$1,612,061	\$1,547,773	100.00	100.00

¹ To avoid revealing individual production, it has been necessary to include sandstone paving, curbing and flagging under the head of "other uses," along with rubble, rip-rap, limestone for agricultural purposes, slate, talc, etc.

Production of Limestone in New Jersey, 1915.

<i>Uses.</i>	<i>Number of Producers.</i>	<i>Quantity in Short Tons.</i>	<i>Value 1915.</i>	<i>Value 1914.</i>	<i>Increase or Decrease.</i>
Road making,	6	15,786	\$8,994	\$13,701	\$4,707 D
Concrete,	3	8,362	5,462	9,838	4,376 D
Blast furnace flux,	7	298,303	141,915	136,038	5,877 I
Other uses, ¹	5	4,982	3,178	81,360	78,182 D
Total,	10	327,433	\$159,549	\$240,937	\$81,388 D

¹ Includes limestone for building stone, rip-rap, railroad ballast, agricultural and other purposes.

The counties producing during 1915 were: Sussex, Hunterdon, and Warren.

Production of Trap Rock in New Jersey, 1915.

<i>Variety.</i>	<i>Number of Producers.</i>	<i>Amount in Short Tons.</i>	<i>Value 1915.</i>	<i>Value 1914.</i>	<i>Increase or Decrease.</i>
Paving blocks,	8	(479,400 blocks)	\$18,033	\$11,645	\$6,388 I
Rubble and Rip-rap,	4	.....	2,056	9,664	7,608 D
Crushed stone—					
Road metal,	47	984,300	752,960	625,536	127,424 I
Railroad ballast,	9	319,292	221,579	222,395	816 D
Concrete,	29	348,218	284,731	276,821	7,910 I
Other values (including rough building stone),	5	.....	2,186	18,468	16,282 D
Total,	51	1,651,810a	\$1,281,545	\$1,164,529	\$117,016 I

a The total amount of crushed rock in 1914 was 1,439,218 short tons.

The leading counties, in order of production, are: Somerset, Hunterdon, Passaic, Essex, Hudson, Mercer, Union and Bergen.

Production of Granite in New Jersey, 1915.

	<i>Number of Producers.</i>	<i>Value 1915.</i>	<i>Value 1914.</i>	<i>Increase, or Decrease.</i>	
Building and monumental,	2				
Rubble and Rip-rap,	2	\$4,129	\$7,391	\$3,262	D
Crushed stone, ¹	5	91,857	67,417	24,440	I
Total,	6	\$95,986	\$74,808	\$21,170	I

¹ The quantity of crushed stone in 1915 was 116,371 tons, being an increase of 13,137 tons over the year before.

Only Morris and Passaic counties reported a production in 1915.

Production of Sandstone in New Jersey, 1915.

<i>Variety.</i>	<i>Number of Producers.</i>	<i>Value 1915.</i>	<i>Value 1914.</i>	<i>Increase or Decrease.</i>	
Building stone (rough and dressed),	8	\$46,981	\$29,954	\$17,027	I
Other uses, ¹	4	16,983	23,440	6,457	D
Total,	9	\$63,964	\$53,394	\$10,570	I

¹ Includes stone for paving, curbing, flagging, rip-rap, road making, concrete, and other purposes.

The counties producing during the year were: Mercer, Hunterdon, Essex Bergen and Somerset, respectively.

Production of Slate and Talc in New Jersey During 1915.

There were three producers of slate during 1915, all in Sussex County.

There was one producer of talc, in Warren County.

The combined value for slate and talc for the year is \$11,017, which is a decrease of \$3,088 from the year before.

SAND AND GRAVEL.

Gravel, building sand and molding sand were the three most important products in this branch of the mineral industry. Burlington, Ocean, Middlesex and Cumberland counties, in the order named, were the chief producers, together contributing 75 per cent. of the total output. The wide distribution of commercial deposits is shown by the fact that seventeen counties were producers among the States. New Jersey stands fifth in value and sixth in tonnage in this source.

Production of Sand and Gravel in New Jersey, 1915.

Variety.	Number of Producers.	Amount in Short Tons.	Value 1915.	Value 1914.	Increase or Decrease.
Molding sand,	31	509,187	\$331,792	\$237,788	\$94,004 I
Glass sand,	4	84,120	64,862	62,595	2,267 I
Building sand,	37	1,838,647	421,927	394,092	27,835 I
Grinding and polishing sand,..	5	79,453	48,236	23,207	25,029 I
Fire or furnace sand,	12	53,113	37,184	33,367	3,817 I
Engine sand,	6	49,676	20,133	21,849	1,716 D
Paving sand,	7	160,256	53,559	39,902	13,657 I
Other sands,	8	81,095	22,476	59,089	36,613 D
Gravel,	31	2,112,557	447,388	672,433	225,045 D
Total,	82	4,968,104	\$1,447,557	\$1,544,322	\$96,765 D

PRODUCTION OF MINERAL WATER DURING 1915.

During the year 1915 New Jersey produced 1,479,479 gallons of mineral water, valued at \$116,226, being 230,551 gallons, or \$39,423 in value, less than the preceding year. Practically all of the output was sold for table water. There were thirteen active springs in the State. Of the nine producing counties, Bergen stood first with 71 per cent. of the total.

LIME.

In order to avoid duplication of values, stone used in making lime, chiefly for fertilizer and building purposes, is not included in the statistics of limestone in the stone industry but is reported separately.

In 1915 the output was 10,273 tons, as against 10,953 for 1914, valued at \$35,393, a decrease of \$5,833. The average value per ton in 1915 was \$3.45 per ton, as against \$3.76 in 1914. The lime was used chiefly for fertilizer and building purposes. Warren, Hunterdon, Somerset and Sussex counties are the chief producers in the order named.

MISCELLANEOUS.

Greensand Marl.—The possibilities of greensand marl as a source of potash and phosphatic acid for fertilizer have attracted considerable attention during the last year, and the State Geologist has received inquiries as to the location of commer-

cially available deposits. The actual production during 1915 was very small, amounting to only a few hundred dollars, and the material being dug entirely for local use.

Sand-lime brick.—The production of sand-lime brick was limited to one operator, located in Camden County.

Mineral paints.—Five companies reported the manufacture of mineral paints in New Jersey during 1915. Those were white lead (both dry and in oil), red lead, litharge, and lithophone, the latter being the most important in value.

Coke and by-products.—As for past years there was a large production of coke and its by-products by one concern located at Camden.

The output of coke and its by-products is combined with that of zinc ore, sand-lime brick, marl and mineral paints in order that the production of individual producers may be concealed. The total value of these products for 1915 was \$10,821,452, as against \$7,979,979 for 1914.

Fig. 9. Boundary Line Serves as a Fire Break on the State Forest Reserves.

Report of the State Forester.

C. P. WILBER, ACTING FORESTER.

In the enforced absence of the State Forester the preparation of the report which follows has fallen upon the writer, who is more familiar with the conduct of the forest fire work than with that of the State Forester in all its details. It may be, therefore, that some phases of the Forester's work will not receive the attention in this report which they would were he able to give it his personal attention.

Forestry in New Jersey, as everywhere, is fundamentally dependent on adequate protection from forest fires. The progress made in better fire prevention and control is dealt with in the State Firewarden's report (see p. 57). With this foundation building up more strongly year by year the commercial and æsthetic value of its forest areas to the State is annually increased. The prolific and spontaneous forest growth throughout the State assures a permanence to its protected woodlands (see Fig. 15). It also insures productiveness more than commensurate with the outlay required, despite the depleted and often inferior present condition of the forest because of long continued neglect and abuse. An area of nearly 2,000,000 acres of forest land (approximately 50 per cent. of the State's area), presents a conservation problem of very real economic importance among New Jersey's many interests and opportunities.

EDUCATION AND PUBLICITY.

Granted protection, each acre of woodland developed and improved by forestry practice is a new resource of public as well as private importance. Whether it be by reason of added timber production, stimulated labor markets, enhanced recrea-

tive value or æsthetic gain, forestry has found a permanent place in the State's needs.

The questions still remain in many minds: are our forest worth protecting, can they be developed to any real value and when conserved what can be done with them? The answer to these question is in each case definite and favorable. (See Fig. 15.) But constant effort must be made to reach the public with the facts and the reasons for them. The Fire Service has brought home, through its extensive system of local wardens, the fact that active measures are being taken in one phase of the work. There is an increasing frequency of requests for specific advice or assistance in forest, woodlot or shade tree problems. This is evidence that the previous ignorance and indifference is giving place to a realization of the need for and the value of a wider application of the principles of forestry and arboriculture.

The annual forestry exhibit of the Department at the Trenton Inter-State Fair, enlarged and revised this year, again attracted large interest and apparently aroused increased understanding. (See Figs. 10 to 14.) The effectiveness of this means of telling of the forestry work has been increasingly felt for several years. The facilities for taking advantage of it more generally have not been available. During the year small forestry displays of office and museum specimens and pictures have been loaned for use in Newark, East Orange, and in Summit in connection with municipal or educational exhibits. This season also it has been possible to prepare and segregate a larger traveling exhibit from the permanent display at Trenton. This exhibit was first set up at the Bergen County Fair and later at a general conference of boys at Atlantic City. It promises to find general favor and usefulness at county fairs, grange meetings, and similar gatherings in the future.

During the year there have been numerous opportunities to present the forestry work in lectures and informal talks. It has been possible to take advantage of many, though not all, of these.

The current "List of Firewardens" was published and dis-

Fig. 10.

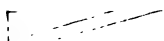


Fig. 11.

Fig. 12.

tributed widely, as heretofore. A special circular on the "Falling of Maple Leaves" and "A Program for Arbor Day" also have been issued to meet specific needs.

STATE FOREST RESERVES.

Continued protection from fire is yearly increasing the forest value of these properties. Some revenue is annually returned from them. With the exception of the Lebanon, where the fire risk is unusually great, none of the areas have suffered any injury in this way during the year. Development is gradually being pushed on all to render them more safe, more accessible, and more valuable. (See Figs. 7 and 9.) As this progresses their value as public recreation grounds is growing and their availability and suitability is becoming better known.

These areas are now and will become more and more of peculiar value for demonstration of what applied forestry does for woodlands, as they are more generally used as outing grounds.

The small Mays Landing Reserve, a 373-acre demonstration area, was sold during the year for \$8,264. The sale makes available this sum for acquisition of one or more new sites of larger area and more advantageous situation. By an understanding with the purchasers, the forest plantations already established will be maintained and protected until their experimental value has been outgrown, thereby assuring that the chief value which the property had will be realized.

A new property, the Jackson Reserve, and a material addition to the Stokes Reserve have been secured in the past year. The present area and location of these, and the previously acquired properties, are summarized below, with a brief outline of the condition and development of each.

Bass River Reserve—Warden, Samuel Budd Allen, New Gretna, 1,633 acres.

Is in Burlington County, six miles northwest of Tuckerton, and is typical of the so-called "pine barrens." A considerable number of experimental plantations and several well developed experimental thinnings are on it.

Jackson Reserve—Warden, Charles H. Thompson, Cassville, ... 42 acres.

Is a new area in Ocean County of unusual accessibility with a forest of nearly pure pine about 35 years old. It is admirably suited to cultural operations such as thinnings and will be so developed.

Lebanon Forest Reserve—Warden, Victor Bush, Pemberton, 3,498 acres.

Is in Burlington County, nine miles southeast of Pemberton. Several experimental plantations and more recent thinnings are on it, but it is used largely as a demonstration in fire control under particularly difficult conditions. Some fire damage has been suffered during the past year, and considerable since the acquisition of the property, but it is in better condition in every way than when it was acquired. A portion of the area is under agricultural development by the Burlington County Feeble-Minded Colony at Four Mile.

Mount Laurel Reserve—Warden, Harvey Darnell, Moorestown, 20 acres.

Is an isolated tract of hardwood and pine in Burlington County, three miles southeast of Moorestown. It is peculiarly accessible and susceptible to forest management, and because of very complete and successful thinnings and plantings five years ago, has unusual value as an example of applied forestry. (See Figs. 20-22.)

Penn Reserve—Warden, George L. Inman, Chatsworth, 2,764 acres.

Is in Burlington County, six miles southeast of Chatsworth. It is a tract of almost pure pine in the heart of the wilderness. The forest is much of it in better than average condition and affords a pointed example of the value of fire protection in developing timber growth under typical conditions in "the pines." (See Fig. 15.)

E. C. Stokes Reserve—Warden, Marcus F. Howell, Branchville, 6,731 acres.

Is in Sussex County, two and a half miles west of Branchville. It is typical of absolute forest land in North Jersey. Under fire protection it is rapidly developing in value. For recreative purposes it is the most suitably situated reserve, and it is hoped that it may be increasingly used in this way. Roads, trails, and camping sites are being provided as fast as facilities permit. The large farm house on the property has been made usable and is now the headquarters and residence of the warden. During the year title has been taken to 1,183 acres of the 1,500-acre addition previously contracted for, and it is expected that the transfer of the remaining 317 acres will shortly be effected.

Swartswood Reserve—Warden, Marcus F. Howell, Branchville, 560 acres.

Is in Sussex County, seven miles northwest of Newton. It consists of Swartswood Lake, with an area of 544 acres, and eight adjacent pieces of upland embracing 16 acres. It is maintained for the use of the public as a park and recreation spot. (See Fig. 3.)

Total, 15,248 acres.

Fig. 16. A Typical Hardwood Woodlot Marked for Thinning. Trees Young and Thrifty, but Too Crowded.

**Fig. 17. Most Towns Might Turn Some Nearby Grove into a Valuable
Recreation Ground at Slight Cost.**

**Fig. 19. Unattractive, Barren School Grounds, Which Could Easily and
Economically Be Transformed by Well Placed Trees and Shrubbery.**

A natural and desirable use of these properties is presented by the growing needs of the State's institutions for dependents. The colony now occupying a portion of the Lebanon Reserve has proven the mutual advantage of such use. Sufficient areas of arable land, and such seclusion as is necessary, are found on each of the larger properties. In addition, the protection and development of the woodlands offer work of every nature to the inmates, and material advantage to the forest.

STATE AIDED FORESTRY.

New Jersey's forest problem is and unquestionably will remain largely a woodlot question. Agricultural and urban development cannot fail to interrupt and curtail the forest areas. Such development is not adverse to but directly in line with the principles of forestry. Good forest practice neither advocates nor tolerates the reservation of soils, more productive otherwise than for growing woodlands, save where some outside public necessity demands permanent forest growth alone. Likewise forestry in the State undoubtedly will long remain a problem of the private owner in large part.

The situation thus presented precludes the regular employment of a forester by most owners. To meet this condition the department offers the services of its foresters, so far as their time will permit, to all who ask for them. To encourage and institute the practice of forestry, woodlot management, forest planting and forest fire protection problems are taken up, and properties visited when advisable and possible. The cost to the owner is the forester's actual expenses while away from Trenton, his salary being paid by the State. During the year a number of new areas have been brought under management in this way, and the work previously undertaken on others maintained. (See Fig 16.) Each such area has its own increased permanent value to the owner in addition to any incidental profit from the operation. It also provides another advocate in itself for the encouragement of other owners.

The most puzzling, and often the insuperable, barrier to forest management and woodland owners is the market problem.

Where forest fire protection is assured, forest development is attractive or repellant in proportion to the ease and profit of exploitation. To bring the user and producer together is another constant effort of the work. The local information available in the Department files for this purpose is yearly increasing by persistent inquiry and the continued coöperation of those who buy or sell forest products.

SHADE TREES.

Interest in this subject is rapidly awakening. Although not forestry proper, shade-tree work is an important adjunct, not only by reason of its own intrinsic value, but because through this avenue the attention and interest of many is first attracted to the larger forestry problem. Especially is this so of the children.

The most recent information lists 70 shade-tree commissions in active operation under the new 1915 law. Too few of these, however, are represented in the South Jersey communities, and particularly in those along the coast.

A phase of shade-tree work which is rapidly developing is the "school-beautiful" idea. Not every school is so situated that shade tree or ornamental planting is advisable or can be done. But on most school properties there is a place for such improvement. (See Fig. 19.) By careful planning, in coöperation with the local shade-tree authorities or with the State Department, bare, unattractive schools are disappearing. The expense need not be large nor the extra care become a serious added burden. The school so favored is both more attractive as a public asset and a source of pride and information to its pupils.

The powers of the department in this work are merely advisory and its facilities for active coöperation limited. However, it seeks to and in many instances during the year has been able to lend assistance to both municipal shade-tree commissions and private citizens. This has been done by visits and by correspondence upon questions of law, of policy and field practice.

The growing favor with which shade-tree work is constantly meeting raises the question of more general provision for trees

Fig. 20. Close Crowded Stand of Hardwoods.

Fig. 21. The Same Stand Immediately After Thinning. Thrifty, Well-Formed Trees Only Left.

Fig. 22. The Same Stand Six Months Later. Tree Crowns Already Beginning to Furnish Ample Shade with Stronger Growth.

A TYPICAL WOODLOT BEFORE AND AFTER A PROFITABLE AND BENEFICIAL THINNING.

along all highways. This movement for rural shade-tree work has already become a live question in some neighboring states. With present facilities and existing legislation, no general endeavor to move in the matter seems possible. However, it is surely fitting that a state so forward in highway development should not lag in this respect. It is hoped that during the coming year some definite beginning may be made to establish and conserve roadside shade trees.

Fig. 23.

TREE PESTS.

Conditions in New Jersey respecting tree enemies are generally encouraging. The serious menaces of insects and diseases, which prevail in or threaten several nearby states, so far have been either kept out of the state or immediately suppressed. Except for the chestnut blight no widespread or serious enemy

appears to have a grip on the local situation. It cannot be too emphatically urged that rigid care in the importation of foreign materials be maintained. Only by hearty private coöperation with those in charge of plant inspection can our forest and shade trees eventually be spared some serious scourge.

The past season has been a particularly favorable one for insects. The Tussock moth, the Tent caterpillar and the Striped Oak worm have thriven on the heavy foliage induced by spring rains. Despite the ease with which they can be controlled, their work is too generally ignored. Although unfortunate, this is, perhaps, to be expected because their ravages are local rather than epidemic. The aggregate harm done is considerable, but the individual infestations are seldom acute enough to arouse local interest in their control. The Hickory Bark beetle has continued to remove weakened trees. It does not menace thrifty hickories, however, and, by proper attention to their nourishment, threatened trees can usually be preserved.

The chestnut blight shows little if any decrease in its vigor, and continues to make havoc in this species. In August, state-wide inquiries and complaints were made because of the failing of lawn and shade trees by general defoliation. Investigation showed that no disease or insect was at work, but that, because of heavy spring rains and a wet summer, the leafage produced was too great for the root systems to support. A circular published described the only treatment possible by fertilizer application and proper pruning. No permanent injury should result in general where such safeguards were applied.

Advice and coöperation are gladly given to any concerned either directly or in collaboration with the State Entomologist and State Plant Pathologist. Do not employ unknown tree doctors.

Report of the State Firewarden.

CHARLES P. WILBER.

THE FIRE SEASON.

November, 1915, the first month of the official year, as usual, ushered in a period of dry weather. Added to this were high winds, the dangerous forest fire conditions due to the fall season and the advent of the gunning season. Though by no means as aggravated as that of the previous year, the situation in the year just closed gave serious trouble. Fourteen per cent. of the year's total fires had burned between November 1st and December 1st.

The midwinter months, December, January and February, as usual, were productive of but few fires of any sort and none of serious importance.

An unusually favorable condition in March continued the winter's freedom from fires beyond the normal period, so that after the close of the preceding November there were no large fires until the opening of April.

The months of April and May developed the scourge of forest fires which annually attends this season. Unusually delayed foliage, frequent high winds, the customary widespread use of fire in "cleaning up" for spring work prevailed. Combined with the usual spring drought these factors produced 48% of the total number of fires recorded for the year, and 63% of all the fires which burned 200 acres or more.

During June and July unusually frequent, though not abnormally heavy, rainfall resulted in a small number of fires, none of which assumed serious size. The two following months, August and September, on the other hand, developed weather conditions quite the contrary. The first month is named in the

official weather record as the driest August since 1885, when the first systematic record was begun, and in September these conditions continued, though slightly less acute. Despite the menace thereby created, there were but 8% of the year's total number of fires recorded in this period. Only one of these burned as many as 200 acres.

October was an unusually bright, clear month, with less than normal rainfall, though no severity of drought. However, the fall conditions again prevailed, and 12% of the total fires for the year burned during the month. A number reached very destructive size, one burning an area of 8,600 acres.

A summary of the year, therefore, brings out clearly a situation so often heretofore remarked. The fall months November and October, with their customary physical conditions favoring fires and with the advent of the open season for game, are shown this year to have produced 26% of all the fires. The spring season, as usual, developed a severe drought. This, with the last year's fallen leaves, the immature foliage of the coming season, and the careless, reckless or ignorant use of fire so universal in these months, created a severe forest fire period.

That physical conditions are not the only, or indeed the major, factor in producing such situations is evidenced again this year. Only one fire, which burned as much as 200 acres, and but 8% of the total fires occurred during the severe late summer drought. In contrast, under not greatly aggravated natural conditions, the two short seasons in which the human factor is emphasized, produced three-quarters of all fires reported and every serious fire. This clearly indicates a personal, not climatological, condition of responsibility.

Table I—Forest Fires in 1916, and in Previous Years.

Year.	No. of Fires.	Total Acres Burned.	Acres per Fire.	Total Loss.	Loss per Fire.
No organized service, incomplete reports.					
1872,		100,000		\$1,000,000	
1880,	54	71,074	1,316	252,240	\$4,671
1885,		128,000		1,128,000	
1895,	49	66,120	1,349	600,000	12,245
1902,	65	98,850	1,520	169,323	2,605
1903,	79	85,046	1,076	305,744	3,870
1904,	81	41,530	512	193,413	2,388
Organized fire service.					
1907,	167	11,525	69	11,647	70
1908,	533	52,978	100	64,536	121
1909,	503	93,525	166	133,944	238
1910,	611	81,452	133	127,850	209
1911, Forest Fires,	289	64,404	122	86,940	165
Embryo Fires,†	239				
1912, Forest Fires,	214	26,291	48	21,501	39
Embryo Fires,†	331				
1913, Forest Fires,	311	53,823	77	67,205	99
Embryo Fires,†	367				
1914, Forest Fires,	396	78,655	92	83,880	99
Embryo Fires,†	451				
1915, Forest Fires,	549	150,258	147	209,090	207
Embryo Fires,†	407				
1916, Forest Fires,	269	51,654	88	69,001	118
Embryo Fires,†	314				

† Burned less than 5 acres.

NUMBER AND AREA OF FIRES.

(See Tables I and II.)

Despite the conditions described above, the Fire Service is evidently taking an increasing grip on the problem.

For the preceding five years the number of fires reported has shown a steady annual increase. This has been felt to register increasing activity and thoroughness in attending and reporting fires, not a discouraging failure to improve conditions. That this situation would not continue was felt certain, and this assurance is apparently justified by the summaries of the past season. Under conditions by no means more favorable than

average, and in the face of records more complete than any heretofore, the total number of fires which started in the State has been markedly less than formerly. (See Table I.) Moreover, the proportion of fires which were put out before they burned an area of five acres is larger than in either of the two years previous. Further, of 314 such fires, 68% were controlled, while still burning over open fields, before they reached the forest which they threatened. Only 8% of the year's total number developed into fires of real seriousness, as against 12% in each of the two seasons previous.

The total area burned-over in the current year was 51,654 acres. This is the lowest figure recorded since 1908, with the exception of the unusually favorable season of 1912. Of this total, 40,350 acres were burned in the spring and the two fall seasons described above. (See p. 57.) Also almost 26,000 acres, or more than half the total acreage, was burned by eight fires. These occurred in these same seasons on days when high winds made the control of any blaze most hazardous. Further, they started in locations whose remoteness and difficulty of access made them very difficult problems.

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Table II—Forest Fires by Relative Area Burned, and by Counties, 1916.

COUNTY.	NUMBER OF FOREST FIRES.					Total Embryo Fires (less than 5 acres).
	5-10 Acres.	11-100 Acres.	101-1000 Acres.	Over 1000 Acres.	Total.	
<i>North Jersey—</i>						
Bergen,	5	1	1	.....	7	10
Hunterdon, .....	.....	.....	.....	.....	.....	.....
Morris,	6	10	2	.....	18	28
Passaic,	7	5	.....	.....	12	12
Somerset,	2	3	.....	.....	5	6
Sussex,	2	7	1	.....	10	14
Union, .....	.....	1	.....	.....	1	2
Warren,	1	3	.....	.....	4	12
Fires that burned in more than 1 county, .....	.....	.....	.....	.....	.....	.....
Totals,	23	30	4	.....	57	84
<i>South Jersey—</i>						
Atlantic,	9	33	8	2	52	64
Burlington,	4	16	7	.....	27	20
Camden,	9	8	5	.....	22	41
Cape May,	2	4	2	.....	8	17
Cumberland,	12	13	6	1	32	22
Gloucester,	1	13	3	.....	17	4
Mercer,	1	.....	.....	.....	1	.....
Middlesex,	3	5	1	1	10	7
Monmouth,	7	3	4	.....	14	14
Ocean,	4	15	3	1	23	38
Salem, .....	.....	4	.....	.....	4	3
Fires that burned in more than 1 county, .....	.....	1	.....	1	2	.....
Totals,	52	116	40	6	212	230
State Totals,	75	146	44	6	269	314
Per cent. of State Totals,	13	25	7	1	46	54

CAUSES OF FIRES.

(See Table III.)

Railroads.

The percentage of fires known to have been caused by railroads is 38%. This is somewhat higher than in the two previous years, but the actual number is far less. Moreover, the proportion of fires from this cause, which are allowed to become true forest fires, annually grows lower. This season 70% of the railroad fires did not burn 5 acres, whereas 50% of the fires in each other class exceeded this acreage. This emphasizes two things: first, that a major cause of forest fire, when known and of reasonably fixed location, is a problem being controlled; second, that the active interest of those in charge of the railroad rights of way each year is more helpful to wardens in keeping railroad fires to small size. It is again repeated, however, that until an equal interest develops in the departments maintaining and operating the locomotives, the preventive measures, which alone will remove the menace, cannot be looked for.

Brush Burning.

Strict administration of the Permit law for brush burning apparently is bearing fruit in a reduced number of forest fires so started. This year the proportion of fires known to have come from brush burnings is 3% less than a year ago, and is but 10% of the total number. The number of fires which are known to have originated from this cause is less than half that of the preceding year, although the period, when such use of fire is commonest, was a season little less dangerous than in the previous year. Of the 59 fires reported from this cause, personal responsibility has been fixed for 44. This persistent determination of responsibility, with the consequent corrective measures and the closer regulated use of fire under the Permit law, is annually reducing the fire loss from this cause. (See Frontispiece.)

Smokers.

Proportionately the number of fires known to have been caused by careless smokers remains approximately the same from year to year. The difficulty of reaching the responsible individual in the majority of cases is plainly evident when the universal and transient character of the menace is considered. It is again repeated that the territory involved is so large, and the smokers so often indifferent or ignorant of the menace they present, that preventing such fires is not possible in the way known or fixed, menaces are controlled. The fires listed from this cause are known to be by no means a complete statement of those so started. A large proportion of the "unknown" column annually hides the identity of smokers' fires. The individual smoker must be rendered conscious of his personal responsibility, and it is only through persistent educational effort that this can be done.

Sportsmen.

An unfortunate anomaly is annually presented by analysis of the year's fires. Those whose sport depends upon the protection of the forest areas from fire persist in a material responsibility for the destruction of their playground. With the more accurate information from year to year available, the proportion of fires definitely chargeable to those who thus use the woodlands for sport grows. Although they are unquestionably many instances in which both the illegal and unsportsmanlike use of fire by gunners cause forest fires, yet by far the greater part of sportsmen's fire are due to carelessness or ignorance. Lighted matches and tobacco are discarded, and camp fires are left burning with no thought of the damage they may do. Like the smokers' fires this class also presents the transient and widespread characteristics discussed in the paragraph above. Persistent and widespread activity in patrolling the more frequented localities in October developed a more certain knowledge of one phase of the question. This effort, with its continuance, will undoubtedly, in large measure, reduce the illegal, dangerous, and unnecessary use of camp fires. But the gunner who smokes in the woods cannot

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be so specifically reached. Fires so caused will continue until the spirit of personal responsibility can be stirred in the individual man.

Miscellaneous Causes.

In number and in their proportion to the total, the fires started by various other known causes are less than heretofore. In many instances such fires arise from causes which cannot be foreseen and provided against, as those which come from burning buildings. In others set by children at play, stationary engines, etc., preventive measures can be taken, and the fires so started are becoming fewer each year.

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Table III—Forest Fires by Causes and Counties, 1916.

COUNTY.	NUMBER.														Totals.
	Locomotive.		Brush Burning.		Smokers.		Sportsmen.		Miscellaneous.		Unknown.				
	FF	eF	FF	eF	FF	eF	FF	eF	FF	eF	FF	eF	FF	eF	
<i>North Jersey—</i>															
Bergen,	2	4				2	1		1	1	3	3	7	10	
Hunterdon, ..															
Morris,	7	6	2	1	1	4	6	5		1	2	11	18	28	
Passaic,	2	6		1		1	6	4			4		12	12	
Somerset,				2		1	1			1	4	2	5	6	
Sussex,	4	9	2	2			2	2			2	1	10	14	
Union,				1						1	1		1	2	
Warren,	2	10						1			2	1	4	12	
Fires that burned in more than 1 county,															
Totals,	17	35	4	7	1	8	16	12	1	4	18	18	57	84.	
<i>South Jersey—</i>															
Atlantic,	8	42	6	3	8	3	4	3	4	3	22	10	52	64	
Burlington, ..	7	8	3	1	1	2	1		1	2	14	7	27	20	
Camden,	10	28	2	4	1	1	2		2	3	5	5	22	41	
Cape May, ...	3	8				3	1	3	1	1	3	2	8	17	
Cumberland, ..	3	6	6	4	4	2	3		3	1	13	9	32	22	
Gloucester, ..	3		4	3	3	1			3		4		17	4	
Mercer,							1						1		
Middlesex, ...	2				3	1	1			1	4	5	10	7	
Monmouth, ..	4	6			5	3		1	2	2	3	2	14	14	
Ocean,	9	21	4	5	3	3	2	1		1	5	7	23	38	
Salem,		1	2	1			1	1			1		4	3	
Fires that burned in more than 1 county,	1										1		2		
Totals,	50	120	27	21	28	19	16	9	16	14	75	47	212	230	
State Totals,	67	155	29	27	29	27	32	21	17	18	93	65	269	314	
Per cent. of State totals, ..	38		10		10		9		6		27				

FF—Forest Fires.

eF—Embryo Fires (less than 5 acres).

THE FOREST FIRE SERVICE.

(See Map.)

The State Force.

To meet changing conditions in the administration of the work, the previous organization has been rearranged. Under this change the former apportionment of the State into four divisions was altered to create three such units. The new scheme has made no reduction in the force, but rendered it more flexible and apparently more effective. The work as now organized makes no change in the north Jersey area, but has redrawn the previous lines in the southern area so that the system now provides one Division Warden, with headquarters at Trenton, available for the entire State, and a field force as follows:

Division A. Headquarters, Dover.

Comprising: Bergen, Essex, Hudson, Hunterdon, Morris, Passaic, Somerset, Sussex, Union and Warren counties, and Middlesex county north of the Raritan river.

Division B. Headquarters, Lakehurst.

Comprising: Burlington, Mercer, Monmouth and Ocean counties, and Middlesex county south of the Raritan river.

Division C. Headquarters, Hammonton.

Comprising: Atlantic, Camden, Cape May, Cumberland, Gloucester and Salem counties.

Such arrangement was made possible because of the standard of efficiency attained by the local service after five years of administration under the enlarged force of State wardens. The season's work again has further strengthened the local service, provided, by no means adequate, but fuller patrol for fires and shown further effectiveness in handling violations of the law.

Local Organization.

The large expansion in territory in the previous year provided organized effort for forest protection in most of the municipalities where conditions seemed to justify or require wardens. There has, therefore, been no attempt to install them in additional townships during the past year. However, to meet immediate local demand the service was instituted in Washington Township, Gloucester County. With this addition the work now embraces 143 municipalities, with 327 wardens, an increase of 17 in the number of men enlisted.

The rising proportion of the fires which start that are extinguished before they attain appreciable size is the most significant indication of the activity and effectiveness of this force. Its growing usefulness is further shown by the readier fixing of responsibility for the fires, a larger share of credit for which annual improvement rests with the local wardens. Stability in the local force has been the keynote toward which the administration of the work has aimed. Continuous effort to replace incompetent or uninterested men by more effective wardens has been necessary since the work first was organized, but each year a larger proportion of efficient wardens has been continued in the service. Although not every district is now served by a satisfactory warden, the proportion of those undesirable has grown small. To further this stability the last Legislature increased the term of service from one to three years. This not only makes for greater permanence in organization, but removes from the Department the heavy administrative burden of the annual reorganization heretofore necessary.

During the year an increased number of both warning and information posters have been placed by the local force. Also each warden has been furnished with an attractive permanent notice to mark his headquarters or the place where word may be left to reach him promptly.



Fig. 24.

A new and very valuable coöperation is that offered by the Bell Telephone Company. Under the plan proposed, one warden available by telephone is now listed with each central operator in the forest sections. Any forest call, unless made for some specific warden, is referred to this one man for personal attention or transmission to the warden in whose territory the fire is burning.

With the rapid increase in the proportion of local wardens available by telephone, this provides both the native and the transient with a means of reaching help promptly and effectively for all fires.

Rural Mail Patrol.

This year the service rendered by rural mailmen has been of increased value. The designation of all such employees as patrolmen by the United States Post Office Department in 1912 upon suggestion from the New Jersey Forest Commission has continued. As the wardens and patrolmen yearly coöperate more closely, prompt notice of small fires, which otherwise might have been serious, becomes more frequent.



**Fig. 25. One Carelessly Dropped Match
or Cigarette May Mean This.**

**Fig. 26. The Little Ground Fires
Make Trees Like This.**

**Fig. 27. Fires Must be Patrolled When the Fighting is Done. This Ember
Was Burning 5 Hours After the Fire Passed.**

Federal Patrol.

Under the so-called Weeks Law the \$2,000 fund annually allotted to this State from the Federal Government for forest fire patrol was continued. As provided by the law the coöperation is only available in the northern portion of New Jersey. In areas under the control of this auxiliary service, fires have been fewer year after year, and the few that do start are not assuming serious proportions. The value of the facilities afforded, both as a fire deterrent and for fire control, has been still further attested by the past season's work. The improved conditions are unquestionably due in part to the increasing efficiency of the local warden service and to the state-wide awakening of public interest. But the patrol has had a virile share both in helping wardens to a greater efficiency and in stimulating the public interest, and coöperation above that, in many territories, not so favored.

The tower equipped by the Newark City Board of Works for lookout service having become unfit for use, the City Board has erected a new structure to replace it. (See Fig. 29.) This station at Cedar Pond, on the city's watershed, has been occupied from April till the middle of November by a lookout watchman.

With the opening of the spring season in April two patrolmen began service. One mounted man served in the territory most dangerous in Passaic and Sussex counties, continuing during the entire year. One man using an automobile patrolled areas in Hunterdon, Morris and Somerset counties, later being transferred to sections of Morris, Sussex and Warren counties, where he continued until the middle of July. When the gunning season opening in the fall an additional force of 10 men were installed to cover the more troublesome situations completely for that period.

Value of the Service.

Few, if any, fires start in such locations or under such conditions that their control is not an economic gain. Few are so innocent of harm that there is no measurable salvage when they are promptly stopped. Vast woodland areas are surely known

to owe their preservation to the wardens and their helpers yearly. However, because of the vagaries of forest fires and the uncertainty of what the capacity of the smallest blaze might be if unattended, the closest estimate of forest values saved by the Fire Service each year could be but vague. But large and definite record of service rendered is possible each year, in addition to the woodland values conserved. The wardens and their helpers in the discharge of regular fire-fighting duties have in the last year saved improved property to the value of more than \$200,000. Seventy-seven homes, 5 industries, 1 church, 2 school houses and 87 miscellaneous buildings are among the listed properties which owe their preservation to the Fire Service. To these are added more than 1,200 acres of cranberry bogs and a large quantity of forest products and agricultural crops.

**Fig. 28. A Lookout Watchman Insures Prompt Discovery and Attack
for Every Fire.**

**Fig. 29. Newark's New Forest Fire
Lookout Station.**

**Fig. 30. Such a Lookout is a Valuable
Help to the Local Warden.**

FOREST FIRE LOOKOUTS.

FIREWARDEN'S REPORT.

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Table IV—Forest Fires by Counties and Townships, 1916.

County and Township.	Number.		Acres Burned.					
	Forest Fires.	Embryo Fires.						
<i>Atlantic County—</i>								
Absecon (City), ..	1	....	10	\$10	\$12.00	\$6.00	\$5.00	.....
Buena Vista,	5	9	135	150	53.00	14.63	14.62	\$28.75
Egg Harbor,	2	2	150	75	63.25	30.63	30.62	5.00
Egg Harbor (City),	1	1	10	10	15.00	7.50	7.50	.....
Folsom, .....	....	2	.....	175	13.50	6.75	6.75	.....
Galloway,	5	19	270	275	137.55	35.65	35.65	67.00
Hamilton,	16	5	2,660	2,605	264.15	124.32	124.33	15.50
Hammonton,	4	13	625	625	126.30	23.67	23.68	80.00
Linwood,	1	....	40	40	20.00	10.00	10.00	.....
Mullica,	10	7	688	615	138.00	28.69	28.71	100.25
Northfield (City),..	....	....	.....	.....	.....	.....	.....	.....
Pleasantville, .....	....	1	.....	20	21.60	10.80	10.80	.....
Port Republic, .....	....	....	.....	.....	.....	.....	.....	.....
Weymouth,	13	7	8,196	8,880	327.46	122.73	127.73	75.40
Total,	58	66	12,784	\$13,480	\$1,191.81	\$421.37	\$426.39	\$371.90
<i>Bergen County—</i>								
Franklin,	1	2	8	\$5	\$21.00	\$10.50	\$10.50	.....
Hohokus,	3	....	261	510	103.25	51.62	51.63	.....
Montvale (Boro.), ..	1	1	5	5	.....	.....	.....	.....
Oakland (Boro.), ..	1	6	12	15	28.75	8.88	8.87	\$11.00
Park Ridge (Boro.)	1	1	10	10	6.00	.....	.....	6.00
Ridgefield (Boro.), ..	....	....	.....	.....	.....	.....	.....	.....
Woodcliffe Lake, ..	....	....	.....	.....	.....	.....	.....	.....
Total,	7	10	296	\$545	\$159.00	\$71.00	\$71.00	\$17.00
<i>Burlington County—</i>								
Bass River,	1	....	8	\$10	\$11.20	\$3.10	\$3.10	\$5.00
Evesham,	1	....	30	30	15.20	7.60	7.60	.....
Medford,	4	4	174	680	163.50	81.76	81.74	.....
New Hanover,	1	1	10	10	15.00	7.50	7.50	.....
Pemberton,	5	8	200	255	101.55	15.36	15.34	95.85
Shamong,	6	2	1,555	2,000	128.70	22.50	22.50	83.70
Southampton,	1	1	150	200	31.80	15.90	15.90	.....
Tabernacle,	2	....	800	700	31.60	10.50	10.50	10.60
Washington,	5	3	885	5,030	190.20	95.10	95.10	.....
Woodland,	6	1	1,150	1,200	88.60	10.70	64.00	13.90
Total,	32	20	4,962	\$10,115	\$777.35	\$270.02	\$323.28	\$209.05

Table IV—Forest Fires by Counties and Townships, 1916—Continued.

County and Township.	Number.								
	Forest Fires.	Embryo Fires.							
<i>Camden County—</i>									
Berlin,	1	1							
Chesilhurst (Boro.)		3			33.45	10.72	10.73		
Clementon,	5	2	22	245	58.75	18.37	18.38	\$22.00	
Delaware,	1			10	14.16	7.08	7.08		
Gloucester,	3	1	161	75	43.75	21.87	21.88	25.00	
Voorhees,		2			4.00	2.00	2.00		
Waterford,	1		100	100	11.60	5.80	5.80		
Winslow,	12	32	1,654	1,914	386.60	90.99	91.01	224.60	
Total,	23	41	2,163	\$2,354	\$564.31	\$168.83	\$168.88	\$271.60	
<i>Cape May County—</i>									
Dennis,	1	6	600	\$430	\$46.60	\$13.80	\$13.80	\$19.00	
Lower,		4			18.00	5.50	5.50	7.00	
Middle,	4	5	236	242	74.90	27.45	27.45	20.00	
Upper,	1	2	20	20	23.60	9.00	9.00	5.60	
Woodbine (Boro.),	2		90	65	26.60	13.30	13.30		
Total,	8	17	946	\$757	\$189.70	\$69.05	\$69.05	\$51.60	
<i>Cumberland County—</i>									
Commercial,	2		58	\$90	\$12.45	\$6.22	\$6.23		
Deerfield,	3	1	45	115	25.50	9.50	9.50	\$10.00	
Downe,	1	1	5	10	17.00	8.50	8.50	5.00	
Fairfield,	3		835	1,635	111.00	55.50	55.50		
Landis,	12	11	3,692	3,792	274.10	121.52	121.58	45.00	
Lawrence,	1		93	100	30.70	15.35	15.35		
Maurice River,	7	2	3,666	6,545	378.21	118.82	145.74	163.65	
Millville (City), ..	9	7	891	1,110	217.40	94.60	94.71	28.00	
Total,	38	22	9,315	\$13,397	\$1,066.36	\$430.10	\$457.11	\$251.65	
<i>Gloucester County—</i>									
Clayton (Boro.), ..									
Elk,	2		32	\$25	\$14.00	\$2.50	\$2.50	\$9.00	
Franklin,	7	1	155	155	56.40	18.77	18.78	35.00	
Monroe,	8	3	713	915	148.13	56.54	62.59	40.00	
Washington,									
Total,	17	4	900	\$1,095	\$218.53	\$77.81	\$83.87	\$84.00	
<i>Hunterdon County—</i>									
Bethlehem,									
Lebanon,									
Tewksbury,									
Total,									

FIREWARDEN'S REPORT.

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Table IV—Forest Fires by Counties and Townships, 1916—Continued.

County and Township.	Number.		Acres Burned.	Loss to Forests and Other Property.	Cost to Extinguish.	Paid by.†		
	Forest Fires.	Embryo Fires.				Township.	State.	Offenders.
<i>Mercer County—</i>								
Princeton,	1	....	5	\$5	\$5.00	\$2.50	\$2.50	\$5.00
Total,	1	....	5	\$5	\$5.00	\$2.50	\$2.50	\$5.00
<i>Middlesex County—</i>								
East Brunswick, ...	2	1	230	\$250	\$21.00	\$10.50	\$10.50	.....
Madison,	1	4	1,100	430	261.80	130.90	130.90	.....
Monroe,	2	1	55	110	23.20	11.60	11.60	.....
Sayreville,	5	1	143	145	43.75	21.87	21.88	.....
South Brunswick, ...	....	....	....	....	....	....	....	....
Total,	10	7	1,528	\$935	\$349.75	\$174.87	\$174.88	.....
<i>Monmouth County—</i>								
Atlantic,	2	2	440	\$400	\$33.00	\$7.50	\$7.50	\$18.00
Freehold,	3	1	290	405	82.35	41.18	41.17	.....
Howell,	8	7	408	475	276.17	124.86	124.86	31.45
Middletown, .....	....	....	....	....	....	....	....	....
Shrewsbury,	4	4	240	1,170	55.20	25.60	25.60	4.00
Wall,	1	....	100	150	5.50	2.75	2.75	.....
Total,	18	15	1,478	\$2,600	\$452.22	\$201.89	\$201.88	\$53.45
<i>Morris County—</i>								
Boonton, .....	....	1	....	....	\$5.00	\$2.50	\$2.50	.....
Chester,	2	2	52	\$25	43.80	13.90	13.90	\$16.00
Denville,	2	2	160	200	54.00	25.50	25.50	3.00
Hanover, .....	....	1	....	....	5.00	2.50	2.50	10.00
Jefferson, .....	....	4	....	....	26.00	11.00	11.00	4.00
Mendham,	1	1	70	100	7.00	3.50	3.50	.....
Montville,	1	1	15	25	12.75	3.87	3.88	5.00
Morris, .....	....	2	....	....	2.50	1.25	1.25	.....
Mt. Arlington,	1	1	10	50	5.50	1.50	1.50	2.50
Mt. Olive, .....	....	1	....	....	7.40	3.70	3.70	.....
Passaic, .....	....	....	....	....	....	....	....	....
Pequanock,	3	2	49	90	83.00	7.50	7.50	57.50
Randolph,	3	....	80	110	27.00	7.50	7.50	12.00
Rockaway,	5	8	458	307	155.48	70.35	70.38	14.75
Roxbury,	4	1	156	165	18.70	7.15	7.15	3.40
Washington, .....	....	1	....	....	2.50	1.25	1.25	.....
Total,	22	28	1,050	\$1,072	\$455.63	\$162.97	\$163.01	\$128.15

Table IV—Forest Fires by Counties and Townships, 1916—Continued.

County and Township.	Number.		Acres Burned.	Loss to Forests and Other Property.	Cost to Extinguish.	Paid by.†		
	Forest Fires.	Embryo Fires.				Township.	State.	Offenders.
<i>Ocean County—</i>								
Berkeley,	2	2	890	\$5,600	\$118.62	\$4.00	\$4.00	\$115.62
Brick, .....	...	3	...	...	15.00	7.50	7.50	...
Dover,	4	1	960	1,110	98.45	39.43	39.42	23.00
Eagleswood, .....	...	...	...	...	5.00	2.50	2.50	...
Jackson,	3	4	55	580	48.75	24.38	24.37	30.00
Lacey,	2	12	3,250	3,250	138.20	13.43	13.42	119.35
Lakewood,	4	4	910	965	115.30	54.77	54.78	20.75
Little Egg Harbor, ..	1	1	10	10	37.80	18.90	18.90	...
Manchester,	9	8	2,092	2,705	174.64	48.32	48.32	58.00
Ocean,	2	...	2,265	2,600	62.40	31.20	31.20	...
Plumstead, .....	...	1	...	...	...	...	...	5.00
Stafford,	1	...	600	600	44.37	22.18	22.19	...
Union,	4	2	3,739	3,580	239.24	119.62	119.62	...
Total,	32	38	14,771	\$21,000	\$1,097.77	\$386.23	\$386.22	\$371.72
<i>Passaic County—</i>								
Pompton,	9	3	305	\$364	\$126.10	\$64.55	\$64.55	...
West Milford,	3	9	22	30	64.25	9.87	11.13	\$43.25
Total,	12	12	327	\$394	\$190.35	\$74.42	\$75.68	\$43.25
<i>Salem County—</i>								
Alloway,	1	1	30	\$60	\$24.00	\$12.00	\$12.00	...
Lower Alloways Creek,	1	...	20	20	16.00	...	...	\$16.00
Pittsgrove,	2	...	72	60	27.40	7.20	7.20	15.00
Quinton, .....	...	1	...	...	5.00	2.50	2.50	...
Upper Pittsgrove, ..	...	1	...	...	2.00	...	...	5.00
Total,	4	3	122	\$140	\$74.40	\$21.70	\$21.70	\$36.00
<i>Somerset County—</i>								
Bernard, .....	...	4	...	...	\$45.00	\$19.50	\$19.50	\$6.00
Bridgewater,	2	1	110	\$100	50.25	25.13	25.12	10.00
North Plainfield, ..	3	...	54	40	25.00	12.50	12.50	...
Warren, .....	...	1	...	...	6.00	3.00	3.00	...
Total,	5	6	164	\$140	\$126.25	\$60.13	\$60.12	\$16.00
<i>Sussex County—</i>								
Andover,	2	\$10.00	\$5.00	\$5.00	...
Byram,	1	8	40	\$10	61.50	23.25	23.25	\$15.00
Frankford,
Franklin (Boro.),

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Table IV—Forest Fires by Counties and Townships, 1916—Continued.

County and Township.	Number.		Acres Burned.	Loss to Forests and Other Property.	Cost to Extinguish.	Paid by.†		
	Forest Fires.	Embryo Fires.				Township.	State.	Offenders.
<i>Sussex County—Con.</i>								
Green, .....	.....	.....	.....	.....	.....	.....	.....	.....
Hampton,	1	.....	20	\$50	\$11.60	.....	.....	\$12.00
Hardyston,	4	2	46	60	40.10	\$6.05	\$6.05	28.00
Hopatcong, .....	.....	.....	.....	.....	.....	.....	.....	.....
Montague,	1	.....	500	500	.....	.....	.....	.....
Ogdensburg (Boro) .....	.....	.....	.....	.....	.....	.....	.....	.....
Sandyston, .....	.....	1	.....	.....	15.20	.....	.....	15.20
Sparta,	1	.....	20	20	2.00	.....	.....	2.00
Stillwater, .....	.....	.....	.....	.....	.....	.....	.....	.....
Vernon,	2	1	105	125	33.50	16.75	16.75	.....
Walpack, .....	.....	.....	.....	.....	.....	.....	.....	.....
Wantage, .....	.....	.....	.....	.....	.....	.....	.....	.....
Total,	10	14	731	\$765	\$173.90	\$51.05	\$51.05	\$72.20
<i>Union County—</i>								
Fanwood,	1	.....	35	\$35	\$15.00	\$4.00	\$4.00	\$7.00
Mountainside, .....	.....	.....	.....	.....	.....	.....	.....	.....
New Providence, .....	.....	1	.....	.....	2.00	1.00	1.00	.....
Springfield, .....	.....	1	.....	.....	2.60	1.30	1.30	.....
Total,	1	2	35	\$35	\$19.60	\$6.30	\$6.30	\$7.00
<i>Warren County—</i>								
Allamuchy,	1	.....	25	\$25	\$25.00	\$12.50	\$12.50	.....
Blairstown, .....	.....	.....	.....	.....	.....	.....	.....	.....
Franklin, .....	.....	.....	.....	.....	.....	.....	.....	.....
Hardwick, .....	.....	1	.....	.....	7.50	3.75	3.75	.....
Harmony, .....	.....	.....	.....	.....	.....	.....	.....	.....
Hope,	1	.....	12	12	11.00	.....	.....	\$11.00
Independence, .....	.....	.....	.....	.....	.....	.....	.....	.....
Knowlton,	1	10	35	85	59.25	.....	.....	59.25
Mansfield, .....	.....	.....	.....	.....	.....	.....	.....	.....
Pchaquarry, .....	.....	.....	.....	.....	.....	.....	.....	.....
Washington,	1	1	5	50	8.50	2.63	2.63	3.25
White, .....	.....	.....	.....	.....	.....	.....	.....	.....
Total,	4	12	77	\$172	\$111.25	\$18.87	\$18.88	\$73.50
State Total, ...	*292	*317	51,654	\$69,001	\$7,223.18	\$2,669.11	\$2,761.80	\$2,063.07

* These totals are greater than the actual number (583) because in 19 cases one fire burned in two or more townships.

† The sum of these columns often differs from the "Cost to Extinguish" item because a fine was larger than the bill, or a bill was withdrawn, etc.

VIOLATIONS OF LAW.

(See Table V.)

In the year just closed the known violations of the forest fire law have been fewer than in the year preceding. However, the proportion of known fires for which responsibility has been fixed upon the offender is higher. In 43% of the fires reported the person or agency through which the fire started has been held to account. In 65 additional cases violations of the permit law, from which no forest fire resulted, were fixed. The total number of cases in which the offenders were apprehended has been 320. Of these, 58% are chargeable to the railroads and 42% to the agencies as follows: 109 cases to brush burning, 7 to smokers, 14 to miscellaneous causes. Of these cases 69% has been finally disposed of. Of the 100 cases still pending 58 are for railroad fires, the settlement on which should be complete before January 1, and but 25 of those from other causes should be still pending with the opening of the new calendar year.

Of the residue of 90 unsettled cases from previous years 10 only remain pending. The penalties collected during the year have amounted to \$1,724.57. Of this total \$1,047.22 was paid by the railroads and \$677.35 by other agencies. The policy of rigid enforcement of the law persisted in is, perhaps, slowly but quite surely telling on the fire prevention problem. The persistent endeavor to use the administration of the law as a corrective, not a punitive, agent has continued to augment local support of the Fire Service. It has also emphasized anew the unfailing purpose to curtail the annual forest fire loss by strict insistence on greater care in the use of fire where necessary and the curtailment of its use where not needed.

Fig. 31. Logging Slash Like this Invites Fire to Start and Makes It Impossible to Control.

Fig. 32. Locomotives Like this Cannot Be Used In or Near the Forest Without Starting Fires. Oil-burners Would be Harmless.

**Fig. 33. Forest Completely Killed by Fire and Nothing to Begin a New Growth From.
CAUSE AND EFFECT.**

FC

EX

LAST
AND
X ONE
OF
THE

W. S. LAMOND
SHEP

MAN
KING, JOHN
KING, JOHN
AT, JOHN
AT, JOHN
KING
KING

WILLIAM
W. W. W.
W. W.

W. W. W.
W. W. W.

W. W.
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FIREWARDEN'S REPORT.

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TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
	Atlantic County—			
April 7, 1916, ...	Buena Vista, ...	W. M. Haddad, ...	Allowed brush fire to escape, ...	Paid fine, \$6.00.
May 10, ...	Buena Vista, ...	Frank Pagugni, ...	Set fire without a permit and allowed it to escape, ...	Released with warning.
May 13, ...	Buena Vista, ...		Set fire without a permit, ...	Paid fine, \$5.00.
			3 fires set by locomotives, ...	Paid firewards' bills, \$5.25.
			1 fire set by locomotive, ...	Pending.
			2 fires set by locomotives, ...	Paid firewards' bills, \$10.75.
			1 fire set by locomotive, ...	Withdawn.
			1 fire set by locomotive, ...	Paid firewarden's bill, \$6.00.
April 11, ...	Egg Harbor, ...	W. C. Burrell, ...	Set fire without a permit and allowed it to escape, ...	Pending.
May 3, ...	Galloway, ...	Atlantic City R. R., ...	Set fire without a permit and allowed it to escape, ...	Paid firewards' bills, \$10.00.
			2 fires set by locomotives, ...	Pending.
			1 fire set by locomotive, ...	Pending.
			1 fire set by locomotive, ...	Case dropped; township bill too tardy.
			9 fires set by locomotives, ...	Paid firewards' bills, \$37.00.
October 10, ...	Hamilton, ...	Pennsylvania R. R., ...	Set camp fire without a permit, ...	Paid fine, \$2.00 each.
October 11, ...	Hamilton, ...	John M. Harley and Leon Davis, ...	Set camp fire without a permit, ...	Pending.
			Set fire without a permit, ...	Dropped; offender fled jurisdiction.
			Set camp fire without a permit, ...	Pending.
			Set camp fire without a permit, ...	Pending.
October 18, ...	Hamilton, ...	Ernest Rufer, ...	Set camp fire without a permit, ...	Pending.
		Philip Gruo and John Tell, ...	Set camp fire without a permit, ...	Pending.
		H. G. Baker and party of fourteen, ...	Set camp fire without a permit, ...	Pending.
		Jacob Brodeck and party of fourteen, ...	Set camp fire without a permit, ...	Pending.
		Pennsylvania R. R., ...	1 fire set by locomotive, ...	Paid firewarden's bill, \$12.50.
April 4, ...	Hammononton, ...	Nick Pegano and Frank Emery, ...	Set fire without a permit, ...	Case dropped; township bill too tardy.
May 2, ...	Hammononton and Mullica, ...	Philip Delalio, ...	Allowed brush fire to escape, ...	Pending.
May 19, ...	Hammononton, ...	Chas. Gazzara, ...	Set fire by careless smoking, ...	Pending.
October 12, ...	Hammononton, ...	Gerard Rubertone, ...	Set fire without a permit and allowed it to escape, ...	Released; secured withdrawal of bill from firefighters.
October 26, ...	Hammononton, ...	Raymond Decamp and party of two, ...	Set fire without a permit, ...	Pending.
		Atlantic City R. R., ...	3 fires set by locomotives, ...	Paid firewards' bills, \$7.00.
		Atlantic City R. R., ...	2 fires set by locomotives, ...	Pending.
		New Jersey Central R. R., ...	1 fire set by locomotive, ...	Paid firewarden's bill, \$14.00.
		Pennsylvania R. R., ...	4 fires set by locomotives, ...	Paid firewarden's bill, \$15.00.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
July 7,	Atlantic County—Con.	Eugene Tarson,	Set fire without a permit and allowed it to escape,	Arrested, prosecuted, convicted and jailed until \$50.00 fine paid.
September 14,	Mullica,	F. Brooks,	Set fire by careless smoking,	Pending.
		Atlantic City R. R.,	3 fires set by locomotives,	Paid firewardens' bills, \$30.75.
		Atlantic City R. R.,	1 fire set by locomotive,	Pending.
		Pennsylvania R. R.,	3 fires set by locomotives,	Paid firewardens' bills \$8.50.
		Pennsylvania R. R.,	2 fires set by locomotives,	Pending.
March 19,	Weymouth,	Mr. Strough and Mr. Wells,	1 fire set by locomotive,	Case dropped; township bill too tardy.
May 3,	Weymouth,	G. Seelman,	Sons set fire without a permit and allowed it to escape,	Released with warning.
May 3-4,	Weymouth,	Atlantic Construction and Supply Co.,	Set fire without a permit and allowed it to escape,	Dropped; insufficient evidence.
May 22,	Weymouth,	Atlantic Construction and Supply Co.,	Locomotive set forest fire,	Paid bill, \$44.10.
October 17,	Weymouth,	Bethlehem Steel Co.,	Employees allowed brush fire to escape,	Paid bill, \$16.50.
		Atlantic City R. R.,	Employees carelessly set forest fire,	Pending.
		Atlantic City R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$14.00.
		Atlantic City R. R.,	1 fire set by locomotive,	Case dropped; township bill too tardy.
May 6,	Bergen County—Oakland,	Well Drilling Juehanna and J.,	Traction engine set forest fire,	Paid bill, \$6.00.
			3 fires set by locomotives,	Pending.
October 29,	Burlington County—Bass River,	hills,	Set fire without a permit and allowed it to escape,	Pending.
April 21,	Medford,		Allowed brush fire to escape,	Pending.
January 26,	Pemberton,		Set fire without a permit,	Paid fine, \$5.00.
March 25,	Pemberton,		Set fire without a permit,	Paid fine, \$5.00.
March 27,	Pemberton,		Set fire without a permit,	Paid fine, \$5.00.
March 27,	Pemberton,		Set fire without a permit,	Paid fine, \$5.00.
March ,	Pemberton,	R.,	Set fire without a permit,	Paid fine, \$5.00.
			4 fires set by locomotives,	Paid firewardens' bills, \$18.25.
			3 fires set by locomotives,	Pending.

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TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916—Continued.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
April 11,	Tabernacle, Shamong, Southampton & Medford,	Thos. Ackerson,	Set fire without a permit and allowed it to escape,	Dropped; insufficient evidence.
	Shamong,	New Jersey Central R. R.,	2 fires set by locomotives,	Paid firewardens' bills, \$14.00.
	Shamong,	New Jersey Central R. R.,	3 fires set by locomotives,	Pending.
August 20,	Tabernacle,	New Jersey Central R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$10.60.
September 5,	Woodland,	Browns Mills Cranberry Co.,	Allowed brush fire to escape,	Pending.
	Woodland,	Browns Mills Cranberry Co.,	Allowed brush fire to escape,	Pending.
Camden County—				
April 16,	Clementon,	C. C. Howard Club,	Set fire without a permit,	Released with warning.
May 7,	Clementon,	Mrs. Sarah Nevius,	Children set fire without a permit,	Released with warning.
April 20,	Gloucester,	Atlantic City R. R.,	2 fires set by locomotives,	Paid firewardens' bills, \$22.00.
	Gloucester,	Henry A. Delano,	Set fire without a permit and allowed it to escape,	Pending.
May 22,	Gloucester,	I. A. Ball,	Set fire without a permit,	Paid fine, \$25.00.
March 28,	Voorhees,	Peter Pierson,	Set fire without a permit,	Released with warning.
January 1,	Winslow,	Ellis Jones,	Set fire without a permit,	Dropped; insufficient evidence.
March 21,	Winslow,	Peter Esposito,	Set fire without a permit,	Paid fine, \$5.00.
March 17,	Winslow,	Antonio Lanzano,	Allowed brush fire to escape,	Paid fine, \$5.00.
March 28,	Winslow,	Leonard Rascavito,	Allowed brush fire to escape,	Paid fine, \$20.00.
April 20,	Winslow,	Marrion Pernice,	Set fire without a permit,	Paid fine, \$5.00.
May 1,	Winslow,	John Bailey,	Son set fire without a permit and allowed it to escape,	Pending.
May 21,	Winslow,	Carl Hildebrandt,	Set fire without a permit,	Paid fine, \$10.00.
	Winslow,	Atlantic City R. R.,	18 fires set by locomotives,	Paid firewardens' bills, \$161.75.
	Winslow,	Atlantic City R. R.,	5 fires set by locomotives,	Case dropped; township bill too tardy.
	Winslow,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Winslow,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Winslow,	New Jersey Central R. R.,	2 fires set by locomotives,	Paid firewardens' bills, \$17.85.
	Winslow,	Pennsylvania R. R.,	2 fires set by locomotives,	Paid firewardens' bills, \$17.85.
Cape May County—				
	Dennis,	Atlantic City R. R.,	3 fires set by locomotives,	Paid firewarden's bill, \$10.00.
	Dennis,	Atlantic City R. R.,	1 fire set by locomotive,	Case dropped; township bill too tardy.
	Dennis,	Pennsylvania R. R.,	1 fire set by locomotive,	Pending.
	Dennis,	Pennsylvania R. R.,	1 fire set by locomotive,	Case dropped; township bill too tardy.
	Dennis,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$7.00.
	Dennis,	Atlantic City R. R.,	2 fires set by locomotives,	Paid firewarden's bill, \$8.00.
	Dennis,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$12.00.
	Dennis,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Lower,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Middle,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Middle,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.
	Upper,	Atlantic City R. R.,	1 fire set by locomotive,	Pending.

TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916—Continued.

DATE	COUNTY AND TOWNSHIP	OFFENDER	OFFENSE	SETTLEMENT.
Cumberland County—				
September 28, . . .	Deerfield,	H. Silverman,	Set fire without a permit and allowed it to escape,	Pending.
August 9,	Downe,	W. H. Robbins,	Set fire without a permit,	Paid fine, \$5.00.
July 7,	Downe,	New Jersey Central R. R.,	Set fire set by locomotive,	Pending.
April 1,	Fairfield,	Francis Cuff,	Set fire without a permit and allowed it to escape,	Released with warning.
April 5,	Landis,	Salvatore Paterno,	Set fire without a permit,	Released with warning.
April 5,	Landis,	E. H. Linker,	Set fire without a permit,	Released with warning.
April 24,	Landis,	W. Zimmer,	Set fire without a permit and allowed it to escape,	Pending.
May 9,	Landis,	Alfred Sheer,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
May 10,	Landis,	Elwood Ford,	Set fire without a permit and allowed it to escape,	Pending.
May 21,	Landis,	G. G. Bora,	Set fire without a permit,	Paid fine, \$25.00.
August 3,	Landis,	Antonio Fiamerugo,	Set fire without a permit,	Pending.
August 15,	Landis,	John Sheppard,	Set fire without a permit,	Pending.
November 9,	Landis,	Pennsylvania R. R.,	4 fires set by locomotives,	Case dropped; township bill too tardy.
	Maurice River,	J. W. Sutton, State Prison Farm Supt.,	Allowed brush fire to escape,	Dropped on request of State Board of Prison Inspectors with assurance against repetition.
May 10,	Maurice River,	Amphy Hysen,	Grandson set fire without a permit,	Released with warning.
May 11,	Maurice River,	Geo. Esbell,	Set an illegal back fire,	Paid fine, \$50.00.
October 18,	Maurice River,	Harry S. Parker and party of thirteen,	Set camp fire without a permit,	Pending.
April 14,	Millville,	Jacob Mann,	Set fire without a permit,	Pending.
May 10-11,	Millville City and Landis Township,	Milton and Howard Caynter and Bennie Sharpless,	Maliciously set fire,	Arrested, remanded by Justice Court to Juvenile Court, convicted and paroled on probation for three years.
October 9,	Millville,	Henry Raymond,	Allowed brush fire to escape,	Pending.
	Millville,	Pennsylvania R. R.,	2 fires set by locomotives,	Paid firewardens' bills, \$22.50.

FIREWARDEN'S REPORT.

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TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916—Continued.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
6				
	Gloucester County—			
April 13,	Elk,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$9.00.
April 13,	Franklin,	Mike Miscarello,	Sons set fire without a permit,	Paid fine, \$5.00.
April 13,	Franklin,	Peter Colucci,	Set fire without a permit,	Paid fine, \$5.00.
April 19,	Franklin,	Tony Travaglino,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
May 4,	Franklin,	James Nichols,	Set fire without a permit and allowed it to escape,	Paid fine, \$15.00.
March 1,	Monroe,	Mrs. Fred Schour and Mrs. Stephen Rumpf,	Children set fire without a permit and allowed it to escape,	Released with warning.
March 31,	Monroe,	Michael Stadnick,	Set fire by careless smoking,	Paid fine, \$10.00.
April 16,	Monroe,	John Estroy,	Set fire without a permit and allowed it to escape,	Arrested, tried, plead guilty, fined \$50.00 and sentenced to 30 days imprisonment in lieu of fine.
April 21,	Monroe,	Maurice V. Warner,	Set fire without a permit and allowed it to escape,	Paid fine, \$5.00.
April 29,	Monroe,	John Knostic,	Set fire without a permit and allowed it to escape,	Paid fine, \$5.00.
May 9,	Monroe,	John Knostic,	Set fire without a permit,	Dropped; insufficient evidence.
May 9,	Monroe,	John Aokayn,	Set fire without a permit,	Paid fine, \$5.00.
May 11,	Monroe,	Samuel Lavinsky,	Set fire without a permit and allowed it to escape,	Pending.
May 13,	Monroe,	John Slobzden,	Set fire,	Paid fine, \$5.00.
		Atlantic City R. R.,	1 fire set,	Paid firewarden's bill, \$15.00.
		New Jersey Central R. R.,	1 fire set,	Pending.
April 21,	Mercer County—			
	Princeton,	G. W. Silvester,	Set fire without a permit,	Paid fine, \$5.00.
July 27,	Middlesex County—			
	Monroe,	Richard J. Drever, Supt. N. J. State Home for Boys,	Set fire without a permit,	Released with warning.
	Sayreville,	Raritan River R. R.,	1 fire set by locomotive,	Case dropped; township bill too tardy.
December 3,	Monmouth County—			
	Atlantic,	New Jersey Central R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$14.00.
	Atlantic,	New Jersey Central R. R.,	1 fire set by locomotive,	Pending.
	Howell,	J. H. Brocklebank,	Set fire without a permit,	Paid fine, \$5.00.

TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916—Continued.

DATE.	COUNTY AND TOWNSHIP.	OFFENSE.	SETTLEMENT.
Cumberland County—			
September 28, ...	Deerfield, ...	Set fire without a permit and allowed it to escape, ...	Pending.
August 9, ...	Downe, ...	Set fire without a permit, ...	Paid fine, \$5.00.
July 7, ...	Fairfield, ...	Set fire without a permit, ...	Pending.
April 1, ...	Landis, ...	Set fire without a permit, ...	Released with warning.
April 5, ...	Landis, ...	Set fire without a permit, ...	Released with warning.
April 24, ...	Landis, ...	Set fire without a permit and allowed it to escape, ...	Pending.
May 9, ...	Landis, ...	Set fire without a permit and allowed it to escape, ...	Paid fine, \$10.00.
May 10, ...	Landis, ...	Set fire without a permit and allowed it to escape, ...	Pending.
May 21, ...	Landis, ...	Set fire without a permit, ...	Paid fine, \$25.00.
August 3, ...	Landis, ...	Set fire without a permit, ...	Pending.
October 15, ...	Landis, ...	Set fire without a permit, ...	Pending.
November 9, ...	Maurice River, ...	4 fires set by locomotives, ...	Case dropped; township bill too tardy.
		Allowed brush fire to escape, ...	Dropped on request of State Board of Prison Inspectors with assurance against repetition.
May 10, ...	Maurice River, ...	Grandson set fire without a permit, ...	Paid fine, \$50.00.
May 11, ...	Maurice River, ...	Set an illegal back fire, ...	Paid fine, \$50.00.
October 18, ...	Maurice River, ...	Set camp fire without a permit, ...	Pending.
April 14, ...	Millville, ...	Set fire without a permit, ...	Pending.
May 10-11, ...	Millville City and Landis Township, ...	Maliciously set fire, ...	Arrested, remanded by Justice Court to Juvenile Court, convicted and paroled on probation for three years.
October 9, ...	Millville, ...	Allowed brush fire to escape, ...	Pending.
	Millville, ...	2 fires set by locomotives, ...	Paid firewardens' bills, \$22.50.

FIREWARDEN'S REPORT.

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TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916—Continued.

	OFFENDER.	OFFENSE.	SETTLEMENT.
April 13,	Pennsylvania R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$9.00.
Franklin,	Mike Miscarello,	Sons set fire without a permit,	Paid fine, \$5.00.
April 13,	Peter Colucci,	Set fire without a permit,	Paid fine, \$5.00.
April 19,	Tony Travaglino,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
May 4,	James Nichols,	Set fire without a permit and allowed it to escape,	Paid fine, \$15.00.
March 1,	Mrs. Fred Schour and Mrs. Stephen Rumpf,	Children set fire without a permit and allowed it to escape,	Released with warning.
March 31,	Michael Stadnick,	Set fire by careless smoking,	Paid fine, \$10.00.
April 16,	John Estroy,	Set fire without a permit and allowed it to escape,	Arrested, tried, plead guilty, fined \$50.00 and sentenced to 30 days' imprisonment in lieu of fine.
April 21,	Maurice V. Warner,	Set fire without a permit and allowed it to escape,	Paid fine, \$5.00.
April 29,	John Knostic,	Set fire without a permit and allowed it to escape,	Paid fine, \$5.00.
May 9,	John Knostic,	Set fire without a permit,	Dropped; insufficient evidence.
May 9,	John Aokatyn,	Set fire without a permit,	Paid fine, \$5.00.
May 11,	Samuel Lavinsky,	Set fire without a permit and allowed it to escape,	Pending.
May 13,	John Slobzden,	Set fire w,	Paid fine, \$5.00.
Monroe,	Atlantic City R. R.,	1 fire set,	Paid firewarden's bill, \$15.00.
Monroe,	New Jersey Central R. R.,	1 fire set,	Pending.
Mercer County—			
Princeton,	G. W. Silvester,	Set fire without a permit,	Paid fine, \$5.00.
Middlesex County—			
Monroe,	Richard J. Drever, Supt. N. J. State Home for Boys,	Set fire without a permit,	Released with warning.
Sayreville,	Jamestown, N. J.,	1 fire set by locomotive,	Case dropped; township bill too tardy.
Monmouth County—			
Atlantic,	New Jersey Central R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$14.00.
Atlantic,	New Jersey Central R. R.,	1 fire set by locomotive,	Pending.
Howell,	J. H. Brocklebank,	Set fire without a permit,	Paid fine, \$5.00.
December 3,			

TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916—Continued.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
May 6,	Howell and Wall,	Bennett Gravel Co.,	Locomotive set fire,	Paid bill, \$5.05.
May 8,	Howell and Wall,	Bennett Gravel Co.,	Locomotive set fire,	Paid bill, \$2.00.
May 10,	Howell,	New Jersey Central R. R.,	4 fires set by locomotives,	Paid firewardens' bills, \$17.40.
May 11,	Howell,	New Jersey Central R. R.,	1 fire set by locomotive,	Pending.
May 12,	Howell,	New Jersey Central R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$4.00.
May 13,	Shrewsbury,	New Jersey Central R. R.,	2 fires set by locomotives,	Dropped, bills too tardy.
Shrewsbury.				
Morris County—				
October 30,	Boonton,	A. O. Miller,	Set fire without a permit,	Pending.
November 1,	Chester,	D. L. and W. R. R.,	2 fires set by locomotive,	Paid firewardens' bills, \$16.00.
November 2,	Denville,	D. L. and W. R. R.,	1 fire set by locomotive,	Paid firewardens' bills, \$1.00.
May 20,	Harver,	Chas. T. Eastburn Co.,	Set fire without a permit,	Pending.
August 25,	Jefferson,	H. V. Coffey,	Set fire without a permit,	Released with warning.
April 11,	Montville,	C. C. Vreeland,	Set fire by careless smoking,	Paid fine, \$5.00.
January 14,	Montville,	W. H. Howell,	Employees set fire without a permit,	Released with warning.
July 6,	Morris,	Carpenter and Knight,	Set fire without a permit,	Released with warning.
October 1,	Morris,	"	Set fire without a permit,	Pending.
October 16,	Morris,	"	Set fire without a permit,	Pending.
October 3,	Mt. Olive,	"	Set fire without a permit,	Released with warning.
October 30,	Pequannock,	N. Y. S. & W. R. R.,	4 fires set by locomotives,	Pending.
November 1,	Pequannock,	N. Y. S. & W. R. R.,	1 fire set by locomotive,	Dropped.
November 2,	Randolph,	N. Y. S. & W. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$12.00.
November 3,	Rockaway,	W. J. C. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$10.00.
November 4,	Rockaway,	W. J. C. R. R.,	1 fire set by locomotive,	Case dropped; township bill too tardy.
November 5,	Rockaway,	W. J. C. R. R.,	1 fire set by locomotive,	Paid bill, \$2.50.
November 6,	Roxbury & Mt. Arlington,	Atlas Powder Co.,	Employees set forest fire,	Paid firewarden's bill, \$1.40.
November 7,	Roxbury,	D. L. and W. R. R.,	1 fire set by locomotive,	Case dropped; township bill too tardy.
November 8,	Roxbury,	D. L. and W. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$2.00.
November 9,	Roxbury,	New Jersey Central R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$2.00.
Ocean County—				
May 31,	Berkeley,	N. D. Yale,	Set fire without a permit,	Paid fine, \$5.00.
September 2,	Berkeley,	M. D. Coleman,	Set fire without a permit,	Pending.
September 3,	Berkeley,	N. J. Central R. R.,	2 fires set by locomotives,	Paid firewarden's bill, \$10.62.
September 4,	Berkeley,	N. J. Central R. R.,	1 fire set by locomotive,	Case dropped; township bill too tardy.
May,	Dover,	Wm. J. Miller,	Set fire,	Paid fine, \$5.00.
April,	Jackson,	"	2 fires,	Paid firewarden's bill, \$8.00.
April,	Jackson,	"	Set fire without a permit,	Paid fine, \$5.00.
April,	Jackson,	"	Set fire without a permit,	Paid fine, \$15.00.
April,	Jackson,	"	Set fire without a permit,	Paid fine, \$5.00.
April,	Jackson,	"	Set fire without a permit,	Paid fine, \$5.00.
April,	Jackson,	"	Set fire without a permit,	Pending.

FIREWARDEN'S REPORT.

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TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916—Continued.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
May 2,	Jackson,	Commodore Cottrell,	Set fire without a permit,	Pending.
June 2,	Lacey,	Cedar Crest Orchard and Produce Co.,	Allowed brush fire to escape,	Pending.
June 2,	Lacey,	Oscar Downs,	Set illegal back fire,	Pending.
October 25,	Lacey,	Fred M. Estell and party of five,	Set fire without a permit,	Pending.
November 4,	Lakewood,	N. J. Central R. R.,	Set fire without a permit,	Paid firewarden's bill, \$53.25.
April 3,	Lakewood,	L. W. Holman,	Set fire without a permit,	Pending.
April 3,	Lakewood,	Kay Melton,	Set fire without a permit,	Released with warning.
April 3,	Lakewood,	Enoch Wall,	Set fire without a permit,	Paid fine, \$3.00.
April 6,	Lakewood,	D. W. F. Brown,	Employees set fire without a permit,	Paid fine, \$3.00.
April 11,	Lakewood,	Albert Patterson,	Set fire without a permit,	Paid fine, \$3.00.
April 11,	Lakewood,	Oscar Olson,	Set fire without a permit,	Pending.
April 24,	Lakewood,	N. J. Central R. R.,	Allowed brush fire to escape,	Paid fine, \$3.00.
January 1,	Manchester,	N. J. Central R. R.,	Set fire without a permit,	Pending.
March 27,	Manchester,	Albert A. Le Roy,	Set fire without a permit,	Released with warning.
May 4,	Manchester,	Chas. Giberson,	Set fire without a permit and allowed it to escape,	Paid fine, \$3.00.
August 6,	Manchester,	John Bell,	Set fire without a permit and allowed it to escape,	Pending.
June 22,	Manchester,	Harold J. Pettes and Victor Stukalo,	Set fire without a permit,	Pending.
June 22,	Manchester,	N. J. Central R. R.,	2 fires set by locomotives,	Paid firewardens' bills, \$8.00.
June 22,	Manchester,	N. J. Central R. R.,	4 fires set by locomotives,	Pending.
June 22,	Manchester,	N. J. Central R. R.,	4 fires set by locomotives,	Case dropped; township bill too tardy.
June 22,	Manchester,	Joshua Emery,	Set fire without a permit,	Paid fine, \$5.00.
June 22,	Pasale County— Pompton,	Harry Conklin,	Set camp fire without a permit and allowed it to escape,	Pending.
April 23,	West Milford,	Wm. E. Howard,	Set fire without a permit and allowed it to escape,	Pending.
April 23,	West Milford,	N. Y. S. & W. R. R.,	3 fires set by locomotives,	Paid fine, \$8.00.
April 23,	West Milford,	N. Y. S. & W. R. R.,	5 fires set by locomotives,	Paid firewardens' bills, \$6.00.
April 18,	Salem County— Lower Alloways Creek,	Edward Nichols,	Set fire without a permit and allowed it to escape,	Paid fine, \$16.00.
January 28,	Pittsgrove,	Paul Schman,	Allowed brush fire to escape,	Paid fine, \$15.00.
August 26,	Upper Pittsgrove,	John Keller,	Set fire without a permit,	Pending.

TABLE V.—VIOLATIONS OF THE FOREST FIRE LAW, 1916—Continued.

DATE.	COUNTY AND TOWNSHIP.	OFFENDER.	OFFENSE.	SETTLEMENT.
May 12,	Somerset County—			
May 12,	Bernard,	Mike Bellay and Steve Honoslosky,	Set fire without a permit and allowed it to escape,	Paid fine, \$3.00 each.
May 22,	Bernard,	Geo. L. Achen,	Set fire without a permit,	Released with warning.
March 31,	Brigewater,	Fred Beckman,	Set fire without a permit and allowed it to escape,	Paid fine, \$10.00.
October 26,	Warren,	Mrs. Jos. Paggio,	Set fire without a permit,	Pending.
May 12,	Sussex County—			
May 12,	Byram,	Mrs. Whitfield Riker,	Set fire without a permit and allowed it to escape,	Released with warning.
May 12,	Byram,	D. L. and W. R. R.,	1 fire set by locomotive,	Paid firewardens' bills, \$15.00.
May 12,	Hampton,	Leslie E. Van Stone,	Set fire without a permit and allowed it to escape,	Paid fine, \$12.00.
October 17,	Hardyston,	N. Y., S. and W. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$4.00.
October 17,	Hardyston,	N. Y., S. and W. R. R.,	1 fire set by locomotive,	Pending.
October 17,	Sandyston,	Geo. Looney,	Set fire without a permit and allowed it to escape,	Pending.
October 17,	Sparta,	N. Y., S. and W. R. R.,	1 fire set by locomotive,	Pending.
November 2,	Union County—			
November 2,	Fanwood Boro,	Mrs. Theo. Hargraves,	Allowed brush fire to escape,	Paid fine, \$7.00.
May 11,	Warren County—			
May 11,	Hope,	John Hesein,	Set fire without a permit and allowed it to escape,	bill, \$23.00.
May 11,	Knowlton,	D. L. and W. R. R.,	1 fire set by locomotive,	bill, \$3.00.
May 11,	Knowlton,	N. Y., S. and W. R. R.,	1 fire set by locomotive,	Pending.
May 11,	Knowlton,	N. Y., S. and W. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$1.00.
May 11,	Knowlton,	L. and N. E. R. R.,	1 fire set by locomotive,	Paid firewarden's bill, \$3.25.
May 11,	Washington,	D. L. and W. R. R.,	1 fire set by locomotive,	

Document No. 47

R E P O R T

OF THE

Department of Conservation
and Development

ON

W O O D F U E L

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Fig. 3. The Same in the Summer After Thinning. The Crown-cover on the Right-hand Portion is Already Dense Enough; on the Left it is Too Thin.

A HARDWOOD FOREST MANAGED FOR SUCCESSIVE CROPS

REPORTS OF THE
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
STATE OF NEW JERSEY

Wood Fuel

by

R. D. FORBES

Assistant Forester

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STATE AID IN FORESTRY.

The Department of Conservation and Development is prepared to assist farmers and other woodland owners—see offer on page 16.

WOOD FUEL.

The purpose of this bulletin is to show how the wood fuel now available in New Jersey can be utilized. While the efforts of the Federal government are being directed toward stabilizing the price of coal, it is doubtful if the shortage of railroad cars and similar conditions will allow of any actual reduction in the price. With chestnut coal ranging between \$7.50 and \$8.50 a ton at the local yards, the rural and suburban portions of the State will do well to consider carefully the use of wood as a substitute.

THE SUPPLY.

Of fuel wood the State has a great supply. The exact figures are not available; there is no doubt that 500,000 cords of wood could be cut to-day from New Jersey's two million acres of forest without removing a single tree, whose present use would not prevent its loss through death and decay, or benefit the surrounding overcrowded stand. If the wood annually grown in the forests of the State were all to be converted into fire wood, one million cords could be obtained each year. If one-half of this production were pine, and one-half hardwoods, it would be equivalent in heating power to one million one hundred and twenty-five thousand tons of coal. It is not advisable, of course, that anything like the entire wood product of the State shall go into cordwood, but in no forest, however well managed, is less than one-fourth of the growth unsuited for any other purpose than as fuel.

We have such an excess of cordwood because unregulated cutting and repeated forest fires have brought our forests to such a state that they produce comparatively little lumber of value, and because the product, such as it is, is too far from a market. There

is, nevertheless, a large quantity of wood in the ten thousand farmers' woodlots scattered over the State, and in the more accessible large bodies of forest, which can be turned into fuel with profit to all concerned. Fifty to seventy-five years ago the cutting of cordwood in New Jersey was a great business, supplying not only the householders of both city and country with domestic fuel, but also many commercial enterprises, as well as lime and charcoal burners. To-day, even in the face of high prices, coal is the cheaper fuel for the railroads and all large commercial establishments. The charcoal burner has been, at least until very recently, unable to compete with the coal dealer, and the lime-burner has almost gone out of business. Finally, by reason of its greater convenience and hitherto nearly equal cheapness, coal has largely replaced wood as domestic fuel, even in the rural districts, while in the towns and cities wood, except as kindling or for open fires, has absolutely disappeared.

Fireplace wood is not here considered because open fires are luxuries, though many opportunities will be found to satisfy the growing demand for such fuel. Power or heating plants in rural sections, especially those connected with institutions, will often find it economical to burn wood rather than coal. Fire-boxes arranged for bituminous coal or small-size anthracite, need not be altered and the wood can be used in lengths that will make the cost materially less than that of stove sizes.

FUEL VALUE OF WOOD.

A pound of *dry* wood of any kind will produce about half as much heat as a pound of anthracite coal; the resinous woods, such as pitch pine, will produce a little more, though this excess is rarely secured in practice, but is lost in smoke or soot. A cord of well-seasoned oak or hickory weighs about 3,800 pounds; a cord of grey birch, black gum, cherry, and similar lighter and inferior hardwoods, such as would be removed in thinning a mixed forest, weighs 3,000 pounds; and ordinary Jersey pine 2,800 pounds. On this basis a cord of hickory or oak is equal in heating value to about one ton (2,000 pounds) of hard coal, and a cord of the poorer hardwoods, or of pine, is equal to about

three-fourths of a ton of coal. It is true that coal is ordinarily more convenient than wood, because it is more easily handled and because it retains its heat longer. On the other hand, good oak coals will often last overnight, and for a quick or temporary fire, wood is often preferred.

In all the calculations herein made it is assumed that the wood is air dry—that is, that it was cut and properly stacked for at least six months, since a part of the heat produced in burning green wood is consumed in driving off (evaporating) the water that is in it. As a matter of fact, more wood is burned while more or less green than after it has become dry. In the present emergency green, or partly green, wood must be used, and its value as compared with coal discounted up to 15 per cent. It is always economical to prepare during one winter the fuel wood to be burned the next.

BURNING WOOD IN COAL STOVES.

Even when coal is cheap many householders burn wood in hot weather because a continuous fire is uncomfortable, and find that no change is necessary in the fire-box, the only difficulties being that the wood must be cut rather short, and that coals are apt to drop through the grate. The latter trouble can be met by laying a metal plate, with perforations in it, over the grate. If wood is to be used regularly it will pay to convert a coal-burning stove into a wood-burner by removing the fire-brick and substituting lighter bricks, which may be bought for about \$1.25. This enlarges the fire-box considerably. For some types of stove a special grate can be bought for from \$2 to \$3.

Years ago wood-burning furnaces with long fire-boxes and close-barred grates were not uncommon. Modern furnaces have round or square fire-boxes, and, though they will burn wood as well as coal, the wood must be short and fed frequently.

WHY WOOD CAN BE USED FOR DOMESTIC FUEL TO ADVANTAGE.

A return to the use of wood for fuel in an extended way is not advocated, but it is believed that many farmers and those who

live in communities off the railroads, will find it advantageous to burn wood. The reasons are:

- (1) It is cheaper.
- (2) It will save coal and release freight cars for other purposes.
- (3) It will give winter work for farm help.
- (4) The ashes are valuable as fertilizer.
- (5) Its cutting can be made a means of improving the woodlands.

(1) *Cheapness.*

Cost of production. A few years ago the standard price for felling, splitting, and ricking a cord of ordinary wood was \$1. To-day it will cost from \$1.25 to \$1.50, allowing for the extra care involved in cutting only part of the trees in a stand, as would be done in making a thinning (see page 12), instead of a clear cutting. A cross-cut saw as a substitute for the wasteful ax is a great money-saver, especially if it is used to saw the larger pieces into stove lengths *before* they are split.

The cost of hauling is a very variable quantity, depending on the condition of the roads and the length of the haul. Under ordinary conditions the average load of fuel wood may be taken as a cord. Sometimes pine can be loaded up to one and one-quarter cords, and green oak cannot be loaded up to a full cord, but for mixed wood, and for average conditions of dryness of the wood and wetness of the roads, one cord is a fair figure for a two-horse team. The number of trips to be made in a day can be fixed only for given localities. At \$6 a day for man and team, three trips would make the hauling cost \$2 a cord and four trips \$1.50 a cord.

Chopping up cordwood into stove lengths, that ancient bugbear of the small boy on the farm, has gone out of practice. A buck-saw is much more economical and efficient than an ax. The average man can buck up about a cord of wood a day, allowing two cuts to a four-foot stick. In many parts of the State portable cut-up saws, driven by gasoline engines, can be hired, with a man to run them for \$10 a day, and will cut up 8 to 10 cords a

Fig. 5. The Same Location After Thinning. Note the Absence of Conspicuous Stumps.

A YOUNG PINE STAND BEFORE AND AFTER A FELLING.

day. Allowing one helper at \$2, the cost of sawing is about \$1.50 per cord. If splitting is done separately, it may be charged for at \$1 a cord, where the wood has already been cut into 16-inch lengths, or is in part too small to need splitting.

Summarizing the foregoing, it is shown that 16-inch wood ready for the stove can be produced for from \$4.25 to \$6.50 a cord without counting "stumpage," or the value of the trees as they stand. And this is fair because fuel wood should always come from trees, or parts of trees, that have no other value, but encumber a forest if they are allowed to remain. On the other hand, cutting and hauling fire wood is usually accounted a spare-time job. In that view a home supply actually costs nothing.

The Comparative Cost of Coal and Wood. Since cord wood is usually cut by farmers and laborers in spare time, and at no actual expenditure of money, it is difficult to compare the home cost of a cord of wood with a ton of coal purchased from dealers for cash.

However, figuring the cost of wood production in dollars and cents for all the labor, the cost of wood will average \$5.00 per cord. On the basis of fuel values as indicated above, anthracite coal to be as cheap as oak and hickory, must be obtained at \$5.00 a short ton, delivered. If the wood is inferior hardwoods or pine, coal would have to sell at \$6.60 a short ton, delivered, to be equally as cheap. For hard coal at the present price of \$8.00 a ton at the yards on the railroad, and the cost of delivering to be added, wood is far the cheaper fuel in many places.

(2) *Release of Freight Cars.*

One of the causes for the prevailing high price of most commodities is the shortage of freight cars and the resulting inability of the railroads to move freight on normal schedules. Anything, therefore, which cuts down the amount of coal the railroads must carry releases so many cars for the shipment of other goods, and tends to relieve the high prices due to distribution difficulties. By obtaining their fuel from their woodlots, or nearby forests, farmers and others help to keep prices down, as well as perform a patriotic duty in the national crisis.

(3) *Winter Work for Farm Help.*

How to find winter work for a valuable farmhand, whose services the farmer will need the following spring, but whom he cannot afford to pay and board all winter unless there is work to be done, has always been a problem on the farm. The same is true of the horses which must be kept in idleness through the winter. To-day, with labor of every kind scarce and experienced farmhands almost unobtainable, with feed prices steadily rising, the problem is more serious than ever. Many farmers will find a partial solution of the difficulty by putting their help to work in the woods. The costs of producing stove-wood, given above, include practically nothing but labor of men and teams. On the assumption that all the labor is done by hand (that is, leaving out of consideration the possible use of a power saw for cutting the sticks into stove lengths), it requires from two to three days' labor to produce a cord of stove-wood—from the stump to the stove. This means that if a farmer living in the average sized farmhouse, and having a family of average size, burns 12 cords of wood for heating and cooking purposes during the year, he can profitably employ his hired man in getting out stove-wood for from 24 to 36 working days every winter. This should look good against a cash outlay for coal of from \$80 to \$100. And if a farmer is so situated that he can sell a quantity of wood he is so much the better off.

(4) *Wood Ashes as Fertilizer.*

The quantity of wood ashes obtained from a cord of wood varies with the conditions under which the wood is burned. About 30 cords of hardwood are required to produce a ton of commercial wood ashes—of a quality equal to the Canadian wood ashes of commerce—but the same quantity of wood consumed as fuel in a cook-stove, or other small, closed burner, would be far more completely reduced and would produce only about one-third to two-thirds of a ton of ash. On the other hand, commercial hardwood ashes contain only 5 per cent. of the valuable fertilizer potash, whereas the stove ashes will con-

tain from 10 to 15 per cent. of potash, so that the amount of potash to be obtained from a cord of wood is about the same, however the wood is burned and regardless of the bulk of the resulting ash. Softwood ashes contain on an average about one-third less potash than hardwood ashes, and the quantity of ash obtained from softwoods is less than from the same bulk of hardwoods because of their greater lightness. The present price of potash is about 25 cents a pound, or \$500 a ton, a figure that almost prohibits its use in fertilizers.

But every farmer knows that potash is needed to make a crop, and though he may not be justified in buying it he will use all he can get. Ashes therefore are valuable, the more that they contain about 2 per cent. of another fertilizing element—phosphoric acid, and 30 per cent. of lime. Figuring that one cord of hardwood will produce 40 pounds of ashes containing 10 per cent., or 4 pounds, of potash now worth \$1, and that the lime and phosphoric acid are worth six cents more, the value of the ashes from every cord of wood burned reduces the cost of the wood itself by any amount up to \$1.06 that a farmer chooses to count.

It is important always to keep wood ashes under cover, as they leach rapidly if allowed to become damp. New ashes should be allowed to cool before they are dumped on the ash heap.

(5) *Improving the Woodlands.*

A very common mistake, and one that has frequently found publicity in the press, is to consider it wrong to cut any cordwood from our New Jersey forests, because such cutting will lessen our supply of saw-timber in the future. It is quite true that to cut into cordwood trees capable of growing to a size fit for lumber, telephone poles, railroad ties, and other high-class products, is an economic waste and a loss to an owner who can afford to wait; it is also true that when cordwood will bring more than timber or other wood products, the forest owner is justified in cutting his woods as soon as they reach profitable cordwood size; provided, of course, he leaves seed trees or makes other provision for a new crop of trees; in other words, provided he practices forestry.

This question of comparative values, however, rarely comes up in New Jersey, because we have an excess of cordwood and can always obtain it in ample quantities from burned or mis-managed forests, or as a by-product in the production of fence-posts, railroad ties, poles, barn timbers, lumber, etc. Better than this, every forest as it grows needs to be stimulated from time to time by the removal of trees that cannot reach maturity. This process is "thinning," an important process in silviculture.

Thinning. In the average wood lot, not badly interfered with by fire, eight or ten times as many young trees occupy the ground five years after the area was cut over as can possibly grow into mature trees. The number of sprouts that start from a single stump well indicate the situation, for all these are attempting to grow into trees in the space where formerly stood the one tree from which they sprang. This tree required, in order to live, a certain amount of light, and a certain amount of food and moisture from the soil. It is plain that if we suppose the trees in the original stand to have been as close together as the nourishment in the soil and the light on their crowns allowed, all but one of the sprouts from each stump, assuming that all sprouted, and that no new trees started from seed, would finally have to die out in competition with their fellows. This is exactly what happens, modified of course by the fact that some stumps fail to sprout and that young trees come up from seed here and there. The same crowding out of all but a few individuals, due to lack of light and nourishment, occurs in stands coming up altogether from seed, as in the case of pines. By going into the stand at intervals to take out the trees that are beginning to drop behind in the race, and keeping from their better neighbors a certain amount of light and nourishment, the woodlot owner, like the man with a hoe in the garden, gets out the excess and worthless growth and increases the final yield of good material. The only difference is that the farmer in his garden cannot use the weeds and many of his culled-out vegetables, whereas in the woodlot he has his year's fuel supply to show for his labor. Thus, instead of cutting off clean a portion of a forest each year, the wise owner will go through a much larger area, removing enough of the poorer, less valuable trees to get the wood he needs, thereby

Fig. 6. Natural Condition Before Improvement.

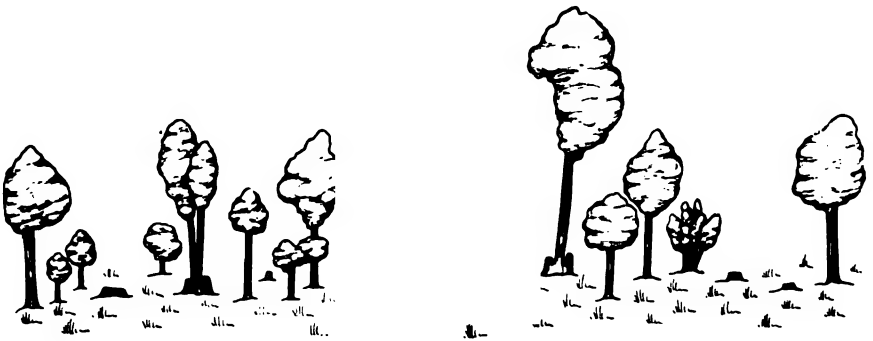


Fig. 7. Same Immediately After an Improvement Felling.

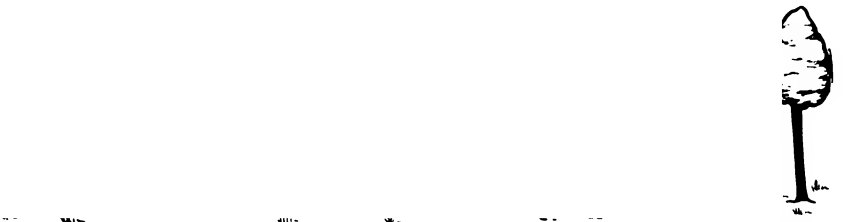


Fig. 8. The Improved Stand After 10 Years. All Trees are Thrifty and the Crowns are Closed Up.

DIAGRAMS REPRESENTING THE TREATMENT OF AN IRREGULAR, HEAVILY-CUT HARDWOOD FOREST.

thinning out the stand and increasing the rate of growth of the better trees which are left.

To thin a woodlot properly requires little but common sense, combined with a knowledge of the habits of various trees and of the value of the wood each kind produces.

Before cutting out any trees in a forest to be thinned, whoever has charge of the work should go through the stand and mark with a blaze the trees to come out, so that the choppers will know what to cut. The following rules should be kept in mind:

1. Take all dead trees sound enough for cordwood; trees of any kind that plainly are dying; all trees of poor kinds that are crowding good kinds, and the poorer individuals of the good kinds if they crowd better individuals of the same kinds, or if they occupy too much space.

2. Keep in mind the trees to be left and give them every help to grow vigorously.

3. When breaking up a group, be careful not to create gaps, but take the trees whose crown space will be filled by neighbor trees within five years.

The following explanation will help in the understanding of the above rules.

The idea of the thinning is to get the stand into a condition where it will produce the greatest amount of valuable material. If the trees grow too closely together they will produce spindling stems with too little crown to furnish food to them. In this case a thinning should take out enough trees to leave growing space for the crowns of those that remain. If so many are taken out that in about five years the crowns of the trees left are still far apart, they will become too bushy, the lower limbs will not be so shaded that they die and leave clear boles of valuable material, and the land will not be raising all the trees that it might. Never thin a stand arbitrarily, taking out, for instance, one tree in four throughout the wood, but be guided by the space between the crowns; this means that in some areas as many as every other tree may be removed, and in other areas none at all.

Do not carry too far the rule to save trees of the better kinds and take out poor kinds. A live aspen is better than a dying

chestnut, and a live birch better than a dying oak. Because of the chestnut bark disease any chestnut showing yellowing leaves in summer, or hanging leaves and burrs in winter, is probably doomed and should be cut. Up to a certain point most trees are able to recover from over-topping, or shading, by their neighbors after the neighbor is cut off, but it is foolish to remove a flourishing, straight-trunked black birch, for example, in order to release from its shade a crooked oak with only a couple of branches, because the oak will probably never be of value.

Tree values. New Jersey forests are of two general types, hardwood and pine. The lumber value of different kinds of trees varies a little with these types and with local industries, but in general the commoner trees may be grouped as follows:

Valuable kinds (the best first): White Oak, Red Oak, Hickory, Ash, Tulip Poplar, Basswood, Red Gum (Bilsted), Black Oak, Black Cherry, Red Maple.

Valuable, but rather slow growing: Chestnut Oak, Two-needle Pine, Pitch Pine, White Cedar, Elm.

Slow growing or wood of little value, except as cordwood: Beech, Red Cedar, Sassafras, Black Gum, Fire Cherry, Black Birch, Yellow Birch, Grey Birch, River Birch, Ironwood, Sycamore, Aspen, Willow.

In selecting the valuable kinds, some attention should be paid to the condition of the soil and the amount of moisture in it. Tulip Poplar, for instance, is a very valuable tree when growing in rich, low land, but a young individual, occurring by chance on high ground with poor soil, is less worth leaving than a Pitch Pine which can stand poor soil and requires little moisture.

If a poor kind of tree is not crowding another, or if it is helping a good tree by shading out the lower limbs, it is well to let it stand. Frequently the choice is between two trees of the same kind; in that case the better individual should be left.

Where several trees of good kinds crowd one another, the rule is to leave those with the most vigorous crowns, the straightest trunks and the healthiest all-around appearance. In other words, the trees that are most likely to produce good material in the long run, whether boards, railroad ties, or any other valuable

product. Trees that show "punk," fire scars, or decayed stubs are likely to be unsound and not worth saving.

Other Sources of Fuel Wood than Thinnings. Thinnings in the woodlot have been dwelt upon at some length, because they should be the chief source of the farmer's fuel supply. There are, however, two other sources of cordwood worth mentioning, namely :

Pastures. On many farms, former pastures have been allowed to come up to Red Cedar, Grey Birch, Aspen, Pine and other trees. The trees came in slowly, and through neglect were allowed to steal much of the pasture from grass. If fuel is to be cut somewhere on the farm, such land as this should be drawn upon first of all and redeemed by removing all the trees and restoring the land to grass. Again, uncleared corners of fields, or patches of agricultural land within the border of the woodlot, may be cut clean, the wood used for fuel and the land eventually farmed. The expense of clearing is thus largely or entirely met by the value of the fuel produced.

Tops and Lops. Thousands of cords of wood from the tops and limbs of trees felled in lumbering operations rot annually in New Jersey or furnish fuel for forest fires. Ordinarily this waste cannot be avoided, because lumbering is important only in the least inhabited parts of the State, and long hauls to cordwood markets are too costly. Sometimes, however, farmers overlook a nearby woods operation as a source of fuel. The material is already down, and can be worked up easily into cordwood. Owners of cut-over land usually are glad to have such material removed.

WOOD-BURNED LIME.

Years ago it was a common custom for farmers to produce lime for their land by burning limestone, or sometimes oyster shells, in kilns on their own farms. The extent of this practice is still attested by many abandoned and weed-grown kilns. For various reasons the use of lime has declined—generally to the disadvantage of the farms, or ground limestone has replaced the burned form.

It has been stated authoritatively that 90 per cent. of the farm land in New Jersey needs lime. This emphasizes the opportunity to employ farm help in winter and utilize an available supply of cordwood by producing agricultural lime wherever stone or shells are available. Burned lime acts more rapidly and is less convenient to use than ground stone; but, apart from the advantage of producing rather than buying the needed supply, the product, not separated from the ashes, carries considerable quantities of phosphoric acid and potash. Manifestly an undertaking of this kind affords a good opportunity for neighborhood co-operation.

AID TO WOODLAND OWNERS.

The State Forester will gladly give owners of forest land in New Jersey advice on the proper methods of thinning and similar operations, and on the marketing of wood products; and so far as his resources permit will send his assistants to examine woodlands and make recommendations on the ground. The charge for such work will be only the expenses, while away from Trenton, of the man making the examination; his salary is paid by the State. Two bulletins, one on *Woodlot Forestry*, the other on *Forest Planting*, will be sent free to any applicant.

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OFFICE, STATE HOUSE, TRENTON.

CHAPTER I.

INTRODUCTION.

CONTENTS.

- The underlying Cretaceous and Tertiary formations.
- The Quaternary formations.
 - General statement.
 - Origin.
 - Principles involved.
 - Complications.
 - Application to New Jersey.

THE UNDERLYING CRETACEOUS AND TERTIARY FORMATIONS.

The southern part of New Jersey south of the area where the Newark series² comes to the surface is underlain by a succession of formations of Cretaceous and Tertiary age which dip

¹ The field work on which this report is based was completed in 1903. The reconnaissance work was done by the senior author, but most of the detailed work was done by Mr. Knapp. Other duties kept him from putting the results of his field studies into written form until long after the field work was completed. This report was prepared by the senior author chiefly from Mr. Knapp's notes. The manuscript was completed in 1912. Various reasons have caused delay in its publication. Preliminary reports regarding these studies were, however, published in successive annual reports of the State Geologist while the field work was in progress. The distribution of the formations has been shown on the Geologic Map of the State, 1910-1912, and also in part in several of the folios of the Geologic Atlas, already published.

For most of the details cited in this report, Mr. Knapp is responsible. Not more than a small portion of the detailed facts which he gathered is here presented. Only those who have tried to unravel the history recorded in such doubtful terms, as in the surface sands and gravels of this region, can appreciate the painstaking effort devoted by Mr. Knapp to the study.—R. D. S.

² In general the southeastern limit of the Newark rocks follows closely the main line of the Pennsylvania Railroad, between Trenton and New Brunswick.

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30 to 40 feet per mile to the southeastward. Because of this dip, the several formations strike northeast and southwest, and come to the surface in succession southeast of the outcrop of the Newark series. The belt where the Cretaceous outcrops, has a width ranging from about 10 miles to about 25 miles. The southeastern border of the belt runs roughly from Salem near the Delaware, to the Atlantic coast near Long Branch.

Formations of Eocene and Miocene age overlie the Cretaceous system, their dip being much the same as that of the older system. Their outcrops continue, in some measure, the belting of the surface occasioned by the outcrop of the successive formations of the Cretaceous system.

Above the beds definitely correlated with the Miocene, there is another pre-Quaternary formation, or perhaps two formations, dipping somewhat regularly to the southeast much as the underlying beds do. This formation (or the older of the two if there be two) is the *Cohansey sand*, the age of which has not been definitely determined; but it is probably late Miocene or Pliocene. In some places, the Cohansey sand is overlain by gravel, which has been called, in various annual Reports of the Survey, the *Beacon Hill gravel*. Whether it is to be regarded as the upper part of the Cohansey formation, or as a separate formation, is an open question. The gravel is perhaps the equivalent of the Lafayette formation farther south, though this is not demonstrated, and is very subordinate in volume to the sand.

THE QUATERNARY FORMATIONS.

General Statement.—The belted character of the surface due to the successive outcrops of the Cretaceous and Tertiary beds, is much obscured by the discontinuous mantle of post-Tertiary or Quaternary gravel and sand which overlies Cretaceous and Tertiary alike. In places, and for considerable areas, this mantle conceals all older beds; but in other areas it is so discontinuous, because of erosion, that the underlying formations are readily seen. This superficial mantle of gravel and sand of Quaternary age corresponds, in a general way, with the surface formations

of the Coastal Plain farther south, which were described formerly under the omnibus name *Columbia formation*. These beds really constitute a *series*, rather than a single *formation*, and the term *Columbia* will be used here to cover the series as a whole, separate names being applied to its several principal members. The divisions of the Quaternary here recognized are three in number. In order of age, they are (1) the *Bridgeton* formation, (2) the *Pensauken* formation, and (3) the *Cape May* formation.

Origin.—Various views concerning the origin of these formations have been held by those who have studied them, and this diversity of interpretation still exists. (1) Some have thought them to be of marine origin, and to represent successive submergences of the southern part of the State up to heights marked by their upper limits, the several submergences being separated by emergences. (2) Others have thought the several formations to be of subaërial origin, that is, deposited on land, chiefly by running water. (3) Still others have thought the formations in question to be partly of subaërial, and partly of marine or estuarine origin. Within the last view, opinion has varied as to the proportion of the series to be assigned to the one origin or to the other. The third view is the one here favored, with emphasis on the subaërial, rather than on the marine or estuarine mode of origin.

The broad question of subaërial accumulation of sediment is one which, until recently, was neglected; but within the last decade or two, recognition of its importance has become general. Deposition of sediments on land is now in progress at the bases of most slopes, and about most high lands, and it is not easy to see how similar results can have failed of realization under similar conditions of climate and topography, at any time in the past. Deposition is effected not merely by rivers which lead from mountains to plains, but by the run-off of every shower which descends from one slope to another of lesser grade or to a flat. The effectiveness of the process and the extent to which sediments may be spread over the surface where conditions are favorable, is best shown on the plains at the bases of mountains.

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Thus the Great Plains at the east base of the Rocky Mountains are more or less generally covered with gravel for scores of miles—in places more than 100 miles—from the mountains. The surface about an isolated mountain is, in some cases, so strewn with debris from the mountain, that nothing but this debris is visible at the surface for miles about it. The plains east of the Andes and south of the Himalayas afford good illustrations of subaërial deposition on a large scale, if the phenomena of these regions have been interpreted correctly.

Perhaps no region affords more striking illustrations of pluvial and fluvial sedimentation than the Great Basin region of the United States. The steepness of the slopes of the Basin Ranges of mountains, the flatness of their surroundings, the relative freedom of their slopes from vegetation, the great changes of temperature which disrupt the rock, and the fitful nature of the precipitation, all contribute to this end. The result is that the plains about and between the mountains are covered, many of them deeply covered, by the debris washed out from the mountains. At the immediate bases of the mountains these accumulations are said to be, in exceptional cases, more than a thousand feet deep. Their depth decreases with increase of distance from the mountains, but is very considerable even scores of miles away in some cases. The Coastal Plain deposits under consideration have many features in common with the deposits at the bases of mountains, though they are on a much smaller scale.

The principles involved.—The essential principles involved in the development of the Quaternary formations of the Coastal Plain, according to the interpretation here favored, are perhaps best understood by a few simple illustrations.

Let us suppose a plain, recently covered by a formation of sand and gravel, to be brought into such a position as to be subject to effective erosion. This might be brought about in various ways, as by the relative uplift of the region which had been the site of deposition. Let it be supposed that a vigorous master stream runs along the lower side of the area, and that tributaries to this stream descend across the plain, at right angles

to their main. Let it be supposed, further, that the main stream reaches such a stage of advancement that it has a wide valley plain at grade. The result is illustrated by Fig. 1, where CD represents a valley plain of degradation, sloping gently toward the master stream. On the upland, A to B, the original gravel formation 1 remains, but its decomposable materials suffer decay by oxidation, carbonation, hydration, etc. Under these circumstances, the plain CD will be strewn with more or less debris derived from the formations 1 and x, but the debris will consist chiefly of the more resistant parts of these formations. Thus if formation 1 contains soft pieces of shale, or pieces of decayed granite, they will not be likely to reappear in the debris

Fig 2

on CD, unless in close proximity to outcrop of 1. At the same time, the material of the lower plain will contain some detritus from x. The result is that the debris on CD may be distinctly unlike the material of formation 1. If the slope between B and

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C is gentle, it, too, will be strewn with more or less debris in transit from the higher to the lower plain.

If now the conditions of the region are so changed that considerable deposition takes place on the plain of degradation, CD, we shall have the result shown in Fig. 2, where CD has been aggraded to EF. The material deposited in the valley will be designated formation 2. If the materials of formation 2 were derived from the same sources as those of formation 1, and deposited under similar conditions, they will be similar to them both physically and lithologically, but more or less unlike the slope detritus between B and C. The aggradation of the main valley to the level EF will be accompanied by the aggradation of all the side valleys, but the debris deposited in them may be somewhat unlike that in the main valley, because derived from more restricted sources, namely from the drainage basins of the tributary streams. These streams may have made some contribution to the deposits in the main valley, but a part of the deposits in that valley were brought in by the main stream. While the valleys are being aggraded, waste from the slopes above the valley bottoms may be accumulating on the surface between the two plains (BE), wherever the gradient is sufficiently gentle.

If erosion succeeds deposition, a new flat lower than EF will in time be developed along the main stream, and harmonious flats along its tributaries. Let it be supposed that these new flats are developed at levels lower than those which preceded. The result is illustrated by Fig. 3. On the plain GH, and on the slope IG where it is gentle, there will be slight accumulations of material, deposited as was that on the plain CD, and the slope BC (Fig. 1) at an earlier time. In constitution, the materials on the slope above G (Fig. 3), will be like those on the older and higher slope BE, except that the formation y may have made some contribution to the former. Meantime there has been more or less shifting of the surface material between B and E. The old has been carried on, and new has been washed down from above and deposited, so that the detritus on this slope (BE) is of all ages younger than that of formation 1, dating its age from the time of its depositions.

If conditions now change so that deposition again succeeds erosion, the flat GH (Fig. 3) will be aggraded, as shown in Fig. 4, giving rise to formation 3. At the same time that the main stream is aggrading its plain, its tributaries are of necessity aggrading theirs, but with material of a different sort, if the tributaries drain terranes different from those drained by the main stream.

Fig 4

While formation 3 is being deposited, the accumulation of waste on the gentle slopes between formations 3 and 2, and between 2 and 1 is in progress. At this stage then, the detritus on the surface between formations 1 and 2 may be of any age and all ages younger than 1, while that on the slope between formations 2 and 3 may be of any age and of all ages younger than 2.

If subsequently erosion again succeeds deposition, new valleys will be excavated in formation 3 of the main valley, and in the corresponding formation in the tributary valleys.

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Complications.—The above illustration embodies the essential principles involved in the development of the *Quaternary* formations of this region, as here interpreted; but the real case is complicated by the fact that the bases on which the several formations, corresponding in a general way to 1, 2 and 3, were deposited, were not plane, and the deposition of the several formations on uneven surfaces complicates their topographic relations. If, for example, the surface beneath formation 1, Fig. 1, were irregular, that formation might, in the depressions of its base, reach a level as low as that attained by the higher parts of formation 2. In this case, there would be no certain way of discriminating between 1 and 2, *on topographic grounds alone*, after erosion has proceeded so far that isolated remnants only of the two formations remain. Corresponding relations might hold between formations 2 and 3. These relations, as a matter of fact, exist.

There is still another complication from the topographic point of view. Thus, while formation 2 was being laid down in the main valley, the corresponding deposits made in a tributary valley rose to higher and higher levels, as the source of the tributary was approached. At the proper distance from the main stream, these deposits in the side valley may have risen to the level of formation 1. Similarly, the deposits made in the valleys of the side streams, while formation 3 was being laid down in the main valley, rise upstream, and, at the proper distance, may reach the level of formation 2 in that valley, or even of formation 1.

Application to New Jersey.—The *Bridgeton* formation is illustrated by No. 1 above, the *Pensauken* formation by No. 2, and the *Cape May* formation by No. 3.

It follows (1) that the borders of the Quaternary formations of this region are not defined by contour lines, though the formations are not independent either of topography or drainage; and (2) that, while there are principal stages of deposition, there are also deposits made at all intermediate stages. If three formations be recognized, corresponding with three principal stages of deposition, it is, nevertheless, impracticable, in some cases, to say with certainty whether a given deposit belongs to one of these

formations or to another, or whether it found lodgment at some time intermediate between the three principal stages of deposition. This is true especially of isolated remnants of one or another of these formations.

The preceding hypothetical cases may be changed to illustrate another phase of the relations of the several members of the series. Let it be supposed that the original plain of deposition, covered by formation 1, sloped to the sea. Erosion of its surface by drainage direct to the sea, after its attitude was so changed as to favor erosion, might result in deposition along the shore. The new sediments would be left somewhat as shown by 2, in Fig. 5, the materials of 2 being derived from the higher

Fig. 5

Fig. 6

parts of 1. If this process were repeated, the result would be illustrated by Fig. 6, where a third formation overlies the sea-

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ward part of 2. It will be seen that the deposits of successive stages would be even less distinct topographically than in the case where deposition took place in valleys.

If in this illustration it be supposed that there is deposition in the valleys as well as along the shore, the deposits in the valleys would rise upstream, and would not be limited at any fixed height above sea level. The separation of the marine and the non-marine deposits would be difficult, and in places perhaps impossible, *on topographic grounds*.

If we conceive of valley deposition and of shore deposition at the same time, with all the complications involved, we perhaps have the proper conception of the manner in which the Quaternary factors of the Coastal Plain were laid down.

CHAPTER II.

THE BRIDGETON FORMATION.

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 - Hominy Hills to Manasquan.
 - Vicinity of Beacon Hill.

Descriptive Summary.

The Bridgeton is a thin formation, composed chiefly of coarse sand and gravel. But at one place and another it contains sand which is not coarse, loam, and even clay. At the other extreme there are boulders of considerable size, but they are few and appear to have been chiefly limited, at the outset, to the base of the formation. Owing to the fragmentary condition of the formation, resulting from its extensive erosion, occasional boulders are the only part which remains in some places, and they appear at the surface not infrequently where streams have cut through the formation, removing all its finer parts.

The formation has two phases which are so unlike that they are best described separately. They will be called the *Glassboro phase* and the *Woodmansie phase*. The former is the better known, and the more distinctive.

GLASSBORO PHASE.

Distribution.—This phase of the formation has its distinctive development in the southwestern part of the State. Its largest continuous surface areas are on the upland which extends southwest from Berlin, and overlooks the lowland bordering the Delaware. Northwest of the escarpment which borders the high land back from the Delaware, there are many outliers of the formation on the crests of hills and divides. Remnants of this phase are found south and west of a line drawn from Berlin down the Mullica River to the Atlantic coast.

Composition.—This phase of the formation consists primarily of gravel and sand, arkose in many places. It contains occasional boulders, and, exceptionally, seams and lenses of clay. The gravel and sand are dug extensively for road material, and characteristic exposures may be seen in pits at numerous points about Berlin, Atco, Williamstown, Glassboro, Pitman Grove and Cohansey on the upland, and in many of the outliers northwest of the main area, as at Houghton's Hill southwest of

Marlton, at Irish Hill north of Chews Landing, at Adams Hill south of Mickleton, at Point Airy east of Woodtown, and at Big Mannington Hill southwest of the same place. Houghton's Hill and Irish Hill show well the distinctive characteristics.

In more detail, the material of the formation is primarily quartzose. The bowlders and larger cobbles are mostly of quartzite or sandstone, and the smaller cobbles and pebbles are mostly of quartz and chert; but bits and even large masses of crystalline rock, such as granite, gneiss, schist, diabase, etc., are present in most places, though not generally abundant. Some of the pieces of crystalline rock appear to have come from the metamorphic formations along the Delaware below Trenton; but the granitic and diabasic fragments come from other and more northerly sources. Some of them are like rock in the Highlands, from which they probably came, and some are like the igneous rocks of the Newark series. Many of the quartzite and quartzose sandstone bowlders and cobbles are so like the Paleozoic sandstone and quartzite of northern New Jersey as to be indistinguishable from them. Pieces of Highfalls (so-called Medina and Oneida and Shawangunk) sandstone are definitely recognizable; so, also, are bowlders of quartzite derived from the Miocene sandstone which once overspread the Coastal Plain, and which was cemented locally into quartzite, though in most places not cemented at all. The Miocene bowlders are abundant locally, and are known as "bulls heads." Many of them have a pinkish or purplish tone.

Besides the sandstone fragments of quartzitic type, there are large and small fragments of red shale and red sandstone which came from the Newark series to the north, or from some other formation so similar to it as not to be readily distinguished. There are occasional pieces of black shale, similar to the Lockatong shale of the Newark series, and pieces of grayish arkose sandstone which are referred with confidence to the Stockton formation of the same series. The crystalline rock and the red shale and sandstone go together in the sense that where one is found the others are likely to be. They are more common at the base of the formation than in any other part of it, and are most

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common in a layer of coarse material a few inches thick at its very bottom (Fig. 9). The crystalline rock fragments, the shale, and other distinctly recognized northern materials decrease in abundance southward.

Much of the sand of this phase of the formation is arkose, and the feldspathic material is, as a rule, completely decayed. The only notable exception is the cores of the larger cobbles and boulders. The clayey element in the sand is not confined to bits of decayed feldspar; films of clay coat the sand grains in many places, increasing the arkose appearance of the whole.

The quartz of the gravel is mostly vein quartz, and might have come from the Paleozoic and older formations north of the Coastal Plain. Some of the bits of chert contain fossils which have been identified as Devonian. Much of the quartz and chert of the formation appear to have come directly from the Beacon Hill gravel which once overlay the older formations of the Coastal Plain, but which was largely removed from the northern part of that plain before the Bridgeton epoch. Some of the sandstone and quartzite also came from the Beacon Hill gravel.

Another constituent of the gravel is ironstone; that is, bits of sandstone or conglomerate, with iron-oxide cement. These came from the Coastal Plain formations. Most of them are from the Beacon Hill gravel and the underlying Cohansey sand. Pellets of clay are also found in some places, and these, too, are from the older formations of the Coastal Plain. Locally, the gravel and sand of the Bridgeton beds are cemented by iron oxide.

Structure.—The sand and gravel are, as a rule, cross-bedded (Fig. 7), but in some cases the exposed face in a pit has an almost massive appearance (Fig. 8). In others there is distinct stratification, emphasized to the eye by long lines of pebbles as seen in the vertical face. In other cases, pebbles are scattered through the sand, while in still others, gravel and sand beds alternate.

Thickness.—The remnants of the formation, as now found, vary in thickness from those too thin to be identified definitely,

Fig. 8.

Bridgeton gravel east of south of Shiloh, Cumberland County.

up to 60 feet. The maximum thicknesses may represent approximately the original thickness of the formation in the localities where they occur. Sixty feet is probably more than its original average thickness, and less than its maximum.

Since its deposition, much of the Bridgeton formation has been removed by erosion. From large tracts all of it has been taken away, and it occurs in considerable areas only on broad divides.

Original extent.—The Glassboro phase of the Bridgeton formation is believed to have been continuous, at the time of its origin, from Long Island, over much of Staten Island, and across New Jersey along the inland margin of the Coastal Plain; that is, from Long Island to Bordentown and thence down the Delaware Valley to the sea. If this view is correct, it has been removed completely from an area of 5–10 miles wide and 100 miles in length, from Amboy to Salem. The only escape from this conclusion lies in the possibility that the Bridgeton formation has been confused with the Pensauken in the northeastern part of this tract. About Amboy, for instance, the Pensauken reaches high elevations, but its base nowhere seems to reach the altitude which would have been expected of the Bridgeton base.

THE WOODMANSIE PHASE.

Characteristics.—The second phase of the Bridgeton formation is found east and north of the Glassboro phase, southeast of a line extending from Glassboro to Keyport; but within this area the formation is represented at the surface by small areas only, if present identifications are correct. In much of this area, however, the differentiation of the several Quaternary formations is very unsatisfactory. The Woodmansie phase is not arkose, and is without the crystalline rock, shale, red sandstone, etc., of the Glassboro phase. It is more largely of sand than the other phase of the formation, and it is thinner. Its materials were derived chiefly from the Miocene and Cohansey formations. In this region, too, the Bridgeton formation is less distinct topographically than in the Berlin-Bridgeton region,

and its differentiation from other formations is difficult, and, in some places, has not been accomplished.

THE BASE OF THE FORMATION.

Pre-Bridgeton topography.—Both phases of the Bridgeton formation seem to have been deposited on a surface which had some relief, apparently a relief developed by stream erosion. At any rate, the base of the formation is somewhat irregular, and at some points the irregularities are conspicuous within short distances, as if old valleys had been filled by the deposits (Fig. 10). Minor irregularities of other sorts are not rare.

The present valleys do not follow in detail the courses of the valleys which existed before the Bridgeton epoch. Yet the pre-Bridgeton surface developed by stream erosion is thought to have had some similarity to the present surface. Knapp thinks that a master stream had the general course of the Delaware below Trenton, following roughly the line of contact of the older rocks with the Coastal Plain (Cretaceous and later) formations, and that tributaries from the east flowed to this master stream somewhat as now. He believes that these tributary streams headed in a divide which extended roughly from Berlin southwestward to Daretown, a little farther northwest than the present divide between the Delaware and the ocean. Southeast of this divide, the course of the streams is thought to have been southeastward, somewhat as now.

The divide referred to above is thought to have been continued northeastward, with increasing height, through the Clarksburg-Perrineville region, to Crawfords Corner, a few miles south of Matawan and Keyport, and thence to the Navesink Highlands. It was continued thence, perhaps without interruption, across Staten Island to Long Island.

If this divide was uninterrupted throughout this distance, the drainage of the Bridgeton epoch was notably different from that of the present time. It may be noted, however, that the above view held by Knapp, is hardly susceptible of demonstration, and that something may be said for the view that the lower Delaware had a more easterly course than now. This view is favored by

Fig. 10.

Bridgeton formation resting upon white glass sand of the Cohansey formation, near Downer, Gloucester County. Note the wavy contact of the two formations.

the distribution of the Glassboro phase of the formation under discussion, as will be seen later.

The remnants of the divide mentioned above are among the most conspicuous features of the topography of the Coastal Plain in New Jersey. The hills at Crawfords Corner (nearly 400 feet high) and Clarksburg are the highest elevations in the southern part of the State. The remnants of the divide farther southwest are lower, but hardly less conspicuous in their surroundings. They are seen in the hills near Ellisdale, in Arneys Mount, and other isolated hills between Clarksburg and Berlin.

If Mr. Knapp's view of the pre-Bridgeton drainage is correct, some idea of the extent to which the former divide has been shifted is made clear by comparing its position, as sketched above, with the present divide between the Delaware and the ocean. The present divide runs from Crawfords Corner, through Freehold, Smithburg, Carr Tavern, Head of Woods, Woodmansie, Tabernacle, and Berlin, to Glassboro.

Northwest of the northeasterly portion of this divide, between Amboy and Bordentown, lay a broad lowland,—perhaps a wide valley plain, in pre-Bridgeton time. This lowland or valley is believed to have been continuous with the valley occupying the site of the lower Delaware. This belt is still a lowland, though it has undergone notable changes since the Bridgeton epoch. The view is entertained that it may have been the course of a large stream, perhaps the ancestor of the Hudson River, which, before the Bridgeton epoch and some of the time since, is thought to have flowed southwestward, reaching what is now the position of the Delaware somewhere between Trenton and Bordentown. If this view is correct, the present outlet of the Hudson, through the "narrows," is of later origin.

In the southwestern part of the State, the Bridgeton remnants have their greatest elevation in the belt of high land extending from Berlin southwestward to Shiloh and Roadstown. West of Bridgeton the base of the formation declines to the southwestward, probably much as the divide of that time did. Southeast of the divide, the base declines to the southeast, toward the ocean. Northwest of the divide, the base declines somewhat

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toward the supposed pre-Bridgeton Amboy-Bordentown-Salem valley. This decline points to a tract along the present Delaware Valley at least 40-50 feet below the low divide to the southeast, at the time the Bridgeton formation was deposited.

Similar relations hold northeast of Berlin. The erosion surface on which the Bridgeton was deposited, or the plain which appears to be the continuation of it, has now an elevation of about 200 feet at Berlin, and thence to Freehold. Above it rose the unreduced hills of the Clarksburg and Crawfords Corner regions. This old plain appears to have sloped southeastward from the divide, declining to 140 feet at Lakewood, 130 feet at Barnegat, 60 feet at Absecon, and 40 feet at Tuckahoe. North of the Amboy-Bordentown Valley, areas at about 200 feet, as in the vicinity of Pennington, may go with this old level. There are tracts of similar elevation in Pennsylvania, as at Norristown, Conshohocken, King of Prussia, Gordon Heights, and along the line of the Pennsylvania Railroad known as the "Cut Off," running southwest from Trenton.

ORIGIN.

According to the interpretation here favored, the accessible parts of both phases of the Bridgeton formation are primarily of terrestrial origin. A part of what now remains may be marine or estuarine, and part of what has been removed may have been.

The Glassboro Phase.—The material of the *Glassboro phase* of the formation is believed to have been brought in largely from the north by rivers, and deposited in the wide valley between Amboy and Salem. The antecedent of Hudson River was one of the chief contributors, if it had the course suggested above. Another principal stream from the north was the ancestor of the Raritan, which, at that time, is believed to have flowed up the present Millstone valley to the Amboy-Trenton valley. In the western part of the State, some of the gravel and sand of the formation were probably brought in by the Delaware, and at Philadelphia, the Schuylkill made it contribution. Streams lead-

ing to the Amboy-Trenton valley from the Coastal Plain brought in sand and gravel from the Cretaceous and Tertiary formations over which they flowed.

West and southwest of Berlin, the Trenton-Salem valley (assuming the drainage to have followed this course) is thought to have been filled up to the level of the divide on its southeastern side, while northeast of Berlin, where the divide was higher, the valley is thought not to have been filled completely. Where the divide was buried, as south of Berlin, material of the sort which filled the valley was spread out to the southeast over the the seaward slope.

The deposits made by the southward-flowing drainage came from areas of crystalline rock, and were somewhat arkose, and the arkose (Glassboro) phase of the formation probably finds its explanation in the drainage of the time. It is limited to the area reached by streams from the crystalline rock to the north. The material of the Woodmansie phase, deposited by streams heading in the Coastal Plain, is not arkose, and is without the distinctive northern constituents which characterize the Glassboro phase.

The composition of the Glassboro phase of the formation seems to be best accounted for on the supposition that the drainage which was responsible for it was glacial drainage, and therefore that the formation was contemporaneous with a glacial epoch. If this is the case, the glacial epoch was the earliest of which there is record in this region. On this hypothesis, the materials of the formation came partly from the basin of the Hudson River by way of Amboy and Old Bridge, and partly from the basins of the upper Raritan and Delaware rivers, both of which joined the main stream through the Amboy-Salem valley. All of these streams are thought to have flowed from the ice, and to have carried such debris as glacial streams carry.

The points which have led to the tentative adoption of this view, may be stated briefly. (1) Much of the material of the formation has the composition which glacial outwash would have had. The association of Triassic, granitic, and Paleozoic

materials, some of them non-resistant, but all from the same direction, and all from terranes known to have been crossed by the ice of an early glacial epoch, favors the view here suggested. On the other hand, the abundance of material derived from the Coastal Plain formations south of the ice is to be explained by the following facts: (a) The existing deposits are some distance from the ice, the irregular edge of which probably extended from Manhattan on the east, to Riegelsville on the Delaware; (b) the easily erodable nature of the Coastal Plain formations, drainage from which flowed to the main depositing stream; and (c) the climate conditions, favorable to erosion in the Coastal Plain at the time the Bridgeton gravels and sands were deposited. (2) Occasional boulders in the Bridgeton formation are as much as 5 feet in diameter. Floating ice seems to be called for in their transportation. Especially do slab-like masses of red shale and sandstone, 40 to 60 miles from their nearest possible source, seem to demand floating ice for their carriage, for, apart from their size, it does not appear that any other agent of transportation could have got the weak masses of shale to their destination without comminution. (3) The likeness of the stony material of the early glacial drift to the coarse material of the Bridgeton formation is great. This likeness applies to the physical condition of the boulders, as well as to the kinds of rock involved. (4) The arkose character of much of the sand is suggestive of a glacial origin. It is difficult to see how such quantities of such material could have been formed and carried so far from its sources, under normal conditions of river action, or by any combination of rain and river erosion with waves and shore currents. (5) The structure of the Bridgeton is very similar to that of glacial outwash, though it is recognized that this structure is not especially distinctive.

This general view does not in itself preclude the hypothesis that the land may have stood somewhat lower than now in the Bridgeton epoch or during some part of it,—low enough, perhaps, to have permitted marine deposits within the area of the present land. But paleontologic evidence of marine deposits of this epoch within the area of the State is wanting.

If the above view concerning the origin of the Bridgeton is correct, corroborative evidence might be expected on the Pennsylvania side of the Delaware, and along the northwest side of the Amboy-Bordentown lowland. The evidence afforded by these regions is meager, though consistent with the view stated above, so far as known. Gravel and sand which may be interpreted as remnants of the Bridgeton formation are found on the west side of the Delaware at various points between Trenton and Chester; but they are so meager as to leave any conclusion drawn from them open to question. If they are remnants of the Bridgeton formation, their meagerness may find a sufficient explanation in the fact that the Delaware flows near the western edge of the supposed pre-Bridgeton valley, and that the Bridgeton formation has therefore been more completely removed from this side of the valley. When the narrowness of the tract on the west side of the stream low enough to have received Bridgeton deposits is considered, it is unlikely that considerable remnants of the formation would have escaped erosion. The case is much the same northwest of the Bordentown-Amboy valley in New Jersey; but evidence that the Bridgeton or some formation similar to it once covered this region, is conclusive.

Northeast of Berlin, Bridgeton remnants in the old Amboy-Bordentown valley are absent, or, if present, have not been identified. It is probable that no deposits of this time, made by drainage through the main valley, persist.

This conception of the origin of the Bridgeton formation is not without difficulties. It is not clear, for example, how streams, even with the help of floating ice, could have carried boulders and large slabs of weak rock from the Newark series, to Hamonton, New Germany (Folsom), and Buck Hill. If streams were the agents of transportation, the course of drainage must have been very different from that of the present time, and there is some evidence that it was not. If, on the other hand, the boulders and slabs of weak material were floated to their destination in sea water, a submergence of more than 100 feet would be called for, and of this there is no clear evidence. If the master stream of southern New Jersey flowed further east than the

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lower Delaware, it would help to explain the southeastward extension of the arkose phase of the formation, and the occurrence of arkose material and its accompaniments, at the localities just mentioned.

The former drainage.—The considerations seeming to point to the course of the ancestor of the Hudson River across New Jersey along the Amboy-Bordentown valley, are as follows: (1) The great volume of the Bridgeton sediments, calling for a large amount of running water, if the deposits are fluviatile; (2) the character of the sediments, pointing distinctly to a northerly source, a character which is quite as evident at the northeast (as about Amboy) as at any point in the valley farther southwest; (3) the tendency of rivers to choose courses along the contact of the Coastal Plain formations with the older and harder formations makes this the appropriate site of a great valley; (4) the topography and drainage south of the Amboy-Bordentown valley, in the eastern part of the State, suggest that drainage flowed northwestward until recent times. Between Matawan and Freehold, for example, Deep Run and Matchaponix Brook, leading to the northwest, are the dominant streams, and their courses suggest a former connection with a southwesterly flowing stream. Matawan and Cheesequake creeks, flowing eastward, are of minor importance, and apparently younger.

The gap in the Rocky Hill range at Kingston probably was utilized by the Raritan when it flowed up the present Millstone valley to join the main stream flowing southwest toward Bordentown. The gorge was probably started after the Beacon Hill epoch. The configuration of the gap itself suggests two stages of history. Its upper part (above the level of 160 feet) is broader, and that below is narrower. The upper part is probably pre-Bridgeton, the lower post-Bridgeton. The part above the 160-foot level perhaps goes with the general plain of erosion which now has an altitude of about 200 feet in the region from Freehold to Berlin, and at Pennington, and is somewhat lower farther south. The river which flowed through the upper part of the valley of Stony Brook, probably joined the same stream that the Raritan joined.

The great river which flowed from the northeast to Trenton or Bordentown probably held this course long after the deposition of the Bridgeton gravels—long enough, indeed, to remove that formation from a belt 5 to 10 miles wide. Knapp thinks there is some evidence that before the deposition of the Pensauken formation, small streams comparable to the upper Millstone River, Manalapan Creek, and Assanpink Creek, heading in the Clarksburg region, flowed northwest across the lowland, some of them turning finally to the northeast, and some to the southwest. Before the Hudson was diverted, it had developed a lowland 30 to 50 feet below the prevailing pre-Bridgeton level.

If the above conclusions are correct, the Hudson was diverted before the deposition of the Pensauken gravels. The method of diversion is not known. If it was not by piracy, it may have been by wave cutting, which conceivably opened up connection between the sea and that part of the stream above Staten Island. Knapp thinks that the first diversion of the Hudson from its old valley was not to its present course, but that it was either eastward, north of Long Island, or, following the suggestion of Veatch, across the western end of Long Island in the vicinity of Jamaica.

Whatever the time of the diversion of the Hudson, and whatever its course in pre-Pensauken time, it seems to have reestablished its course to the southwest during the Pensauken epoch. This might have been the result of the blocking of the eastern outlet by glacial drift, or by outwash from the ice in the glacial epoch contemporaneous with the deposition of the Pensauken formation.

The above hypothesis as to the former course of the Hudson is not without difficulties. Thus the surface of aggradation should have been at least 50 feet higher, say at Freehold, than at Berlin, to make transportation to the southwestward possible. If it had been built up 50 feet higher at Freehold than at Berlin, the gravel would have been carried over the divide to the southeast, unless the divide was then higher (which is not improbable) than now; but gravel of this sort is not found southeast of the divide. Again if the Freehold divide was then high enough to

stop the overspread of gravel and sand to the southeast, the valleys down the southeast slope should have shown the effect of this altitude; but such effects have not been recognized. It would seem, therefore, either that the region about Berlin must have been lower then than now, relatively, or elevated since. While fluvio-glacial waters were depositing sand and gravel along the lines of their flow, other sands and gravels must have been accumulating in the valleys which did not carry glacial waters. In valleys tributary to the Delaware there must have been deposits of sediment brought down from higher parts of the Coastal Plain, while the Delaware Valley itself was being filled up with fluvio-glacial debris. If the southern part of the State was then lower than now, floating ice may have had a share in the remarkable deposits referred to the Bridgeton formation, such as those about Folsom, Hammonton, Tuckahoe, etc., where the large blocks of soft red shale and sandstone appear to be so anomalous as to make the presence of floating ice seem necessary. Possibly the southern part of the State was low enough during some stage of the epoch, to convert the area of the present lowland between Raritan Bay and Trenton into a sound; but of such submergence specific evidence is wanting.

The Woodmansie Phase.—While the deposition of the Glassboro phase of the formation was in progress, other deposits were being made by the streams which were not so situated as to receive glacial drainage.

Theoretically, the deposits made in the valleys of streams flowing to the southeast from the divide northeast of Berlin, at the time sedimentation by fluvio-glacial waters was in progress in the main Delaware Valley, constitute the second (the Woodmansie) phase of the Bridgeton formation, which is confined to the area southeast of the Amboy-Bordentown Valley, and north of Mullica River. Practically, the deposits of this time in this area are difficult of identification. They possess none of the distinctive features of constitution which are relied on for identification of the Bridgeton formation farther south and west, and their topographic positions become less and less distinctive as sea level and the coast line are approached. Neverthe-

less we may recognize certain beds, which, from their topographic relations, we infer to be of Bridgeton age. These gravels, sands, etc., were derived from local formations, and must have been deposited under conditions which were somewhat different from those of the present time. These conditions may have been either climatic or topographic, or both. If, for instance, the Bridgeton epoch was an epoch when the land was sinking, so that the ocean encroached upon it, marine deposition must have taken place in the lower ends of the valleys and along the coast.

Local Details.

THE GLASSBORO PHASE.

GENERAL OCCURRENCE.

The largest areas of the Bridgeton formation occur in the northeast-southwest belt between Berlin and Shiloh (a few miles west of Bridgeton), along the divide between the drainage which flows westward into the Delaware and that which flows to the southern and southeastern coast. But even here the continuity of the formation is interrupted by the headwater tributaries of Great Egg Harbor and Maurice rivers, and of Timber and Mantua creeks. A line drawn from Clementon southwest through Mullica Hill, Harrisonville, Yorktown and Roadstown (5 miles west of Bridgeton) would mark approximately the northwestern limit of all considerable areas of the formation, though to the northwest of this line small outliers cap some of the higher hills which have been separated from the highland to the southeast by erosion.

The general relations of the Bridgeton formation will be brought out in connection with a series of sections, mostly at right angles to the strike of the formations of the Coastal Plain. The order in which these sections will be described, is from the south to the north.

SOUTH OF ALLOWAYS CREEK.

Distribution.—The first of the sections extends from the Delaware opposite Salem, through Burden Hill and Shiloh to Cohansey Creek and beyond. This section (Fig. 11)¹ shows the Bridgeton formation capping all the level lands along this line above the elevation of 110–120 feet. At a lower level to the west, mostly below 60 feet along the line of the section, is a second formation, the Pensauken, from which the Bridgeton is here thoroughly distinct topographically, though the two are much alike in composition. This section is fairly typical of the southwestern part of the State.

The most westerly remnant of the Bridgeton formation is about 6 miles east-southeast of Salem, and about 2 miles south-east of Quinton, at Burden Hill. The summit of the hill has an elevation of about 130 feet, and the base of the formation is 20 or 30 feet lower. The gravel and sand, principally the latter, are arkose.

East of Burden Hill the formation covers the higher hills and uplands forming the broad divide between Cohansey Creek on the east and Stow Creek and Alloways Creek on the west. The general relations of the formation, topographically and stratigraphically, are shown in Fig. 11, which makes it clear that the formation antedated the development of the lowland along the Delaware.

Unevenness of base.—From Burden Hill southeast to Bridgeton, the base of the formation declines from about 110 or 120 feet, to about 80 feet, or about 30 feet in 10 miles; but since the base of the Bridgeton is uneven, it can hardly be assumed that this is its average dip to the southeast. The formation, indeed, does not have so regular a dip as the older formations on which it rests. Its base declines slightly toward Cohansey Creek from both sides, suggesting that there was a valley in pre-Bridgeton time near the site of this stream. This and many other harmonious facts indicate that the formation rests on an erosion surface of slight relief.

¹Figs. 11, 15, 16, 18, 19, 20, 22, 23, 24, 25, 26, 27 are on Plate A, facing p. 40.

The unevenness of its base may be seen at various points, as at the headwaters of Deep Run, east of Dilks Mill. Three-fourths of a mile east of this mill, and a mile southwest of Friesburg, the base of the Bridgeton has an altitude of about 120 feet. South of this point, the base runs down to 90 feet within a mile. The low level is interpreted as representing a pre-Bridgeton valley, but here, as in some other cases, it is possible that the low level of the Bridgeton material is the result of down-slope creep since the adjacent valleys were excavated.

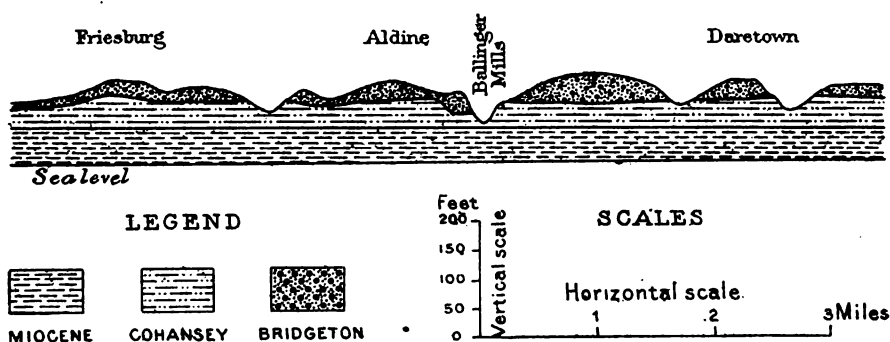


Fig. 12.

Relations of the Bridgeton along a section from Friesburg to Daretown.

About Aldine, the base of the Bridgeton formation is notably irregular. At Aldine it has an altitude of about 110 feet, but half a mile to the west, 120 feet. Half a mile north, there is a headland at Ballinger's Mill, which has an elevation of 120 feet. The mill pond has an elevation of 84 feet, and the base of the Bridgeton is but a few feet above it. The general relations of the formation are shown in Fig. 12. To the west, east, and south of Aldine, the base of the formation is not below 100 feet, and is in many places 100 to 120 feet, so that the old valley where the base of the Bridgeton appears at 90 or below, seems to have had its outlet to the west.

Constitution.—To the west, the constitution of the formation is normal, but in the region about Bridgeton it is difficult, in many places, to distinguish the Bridgeton formation from the Cohansey which underlies it. Locally most of the material of

the younger formation was derived from the older, and there the distinction is most difficult, for the Bridgeton is not arkose. At Harris's Quarry, $1\frac{3}{4}$ miles southwest of Cohansey, and $1\frac{1}{2}$ miles southeast of Pecks Corners, at the 100 to 110-foot level (Fig. 13, p. 30), the sand is cemented into ferruginous sandstone, which, for the most part, resembles the Cohansey formation rather than the Bridgeton; but the occasional cobbles and large pebbles seem to indicate its correlation with the Bridgeton, for coarse gravel is absent, so far as known, from the Cohansey sand. Material which is similar, except for the gravel, is to be found in the south bank of Hepnor Run, 2 miles south of Bridgeton. In this latter place, there is nothing to favor the reference of the sandstone to the Bridgeton formation, as against the Cohansey.

Where the Cohansey sand is coarse, and especially where it is associated with fine gravel, as is the case in many places, and where the Bridgeton is of coarse sand with only fine gravel intermixed, the two may be inseparable on the basis of available data.

The Bridgeton formation of the Bridgeton region may be said to center about Elmer, beyond the headwaters of Alloways Creek and Salem Creek. Considerable areas extend off to the south on the divides east and west of Cohansey Creek. Within this general area the altitude of its surface ranges from about 160 feet to 100 feet, and its base has a smaller range from 120 feet at the north to 80 feet at the south.

BETWEEN ALLOWAYS CREEK AND OLDMANS CREEK.

Distribution.—The Bridgeton formation caps the divide between these creeks, extending out to the northwest from the highlands to the southeast. Northwest of the main divide between these creeks, there are outliers of the formation on hills which have been isolated by erosion. The general relations of the formation are shown in Figs. 14 and 15 (p. 40).

On the uplands to the east the surface of the Bridgeton has an altitude of 140 to 160 feet. The tops of the outliers to the west have an altitude ranging as low as 129 feet on Big Mannington Hill. The original surface of the formation at the east

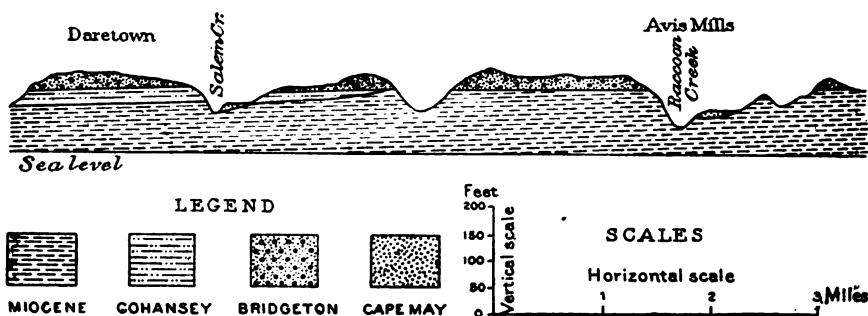


Fig. 14.

Section from Daretown to Avis Mills, Oldham Creek.

appears to have corresponded with the present altitude of about 150 to 160 feet, and the lower altitudes of the surface now, are due to subsequent lowering by erosion.

The base of the formation here has an elevation of 100 to 120 feet. Its thickness therefore reaches 40 to 50 feet, and perhaps occasionally even 60 feet. This conclusion is drawn from the elevation of the surface, and the known altitude of the base at various points. No thickness of 60 feet has been seen in section, but thicknesses of 45 feet are indicated at several points by the records of wells.

About Daretown, the base on which the Bridgeton rests is not very irregular, as shown by Figs. 14 and 15. Such irregularities as that shown in Big Mannington Hill may be partly or wholly the result of displacement of the surface material. If not, this outlier indicates that the pre-Bridgeton surface declined a little to the west.

The relations of the Bridgeton formation north of Salem Creek are much like those to the south. Thus about Whig Lane, the broad interstream areas are generally covered with Bridgeton gravel and sand. To the west, the formation becomes more and more dissected, and its last remnants in this direction are small outliers such as that seen on the hill $1\frac{1}{2}$ miles southeast of Auburn (Fig. 16, p. 40). The base of the formation is rather even along this divide, so far as known, and slightly higher than south of Salem Creek, ranging from 120 to 130 feet. At points,

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however, as about Avis Mills, the base is a little lower. The maximum thickness of the formation here is 40 feet, or possibly a little more.

Exposures.—There are good exposures of the Bridgeton formation between Salem Creek and Oldmans Creek. One is at a gravel pit three-fourths of a mile north of west of Pitts Grove (Pole Tavern), where 7 or 8 feet of gravel carrying cobbles and occasional boulders may be seen. The formation here rests on the glass-sand phase of the Cohansey formation. The gravel is compact, and is distinctly stratified in rather regular horizontal beds. Bits of crystalline rock are common, though no red shale was seen. A mile northwest of Whig Lane is another good exposure showing 6 or 7 feet of compact gravel with only sand enough to fill the interstices between the pebbles. Another pit $1\frac{1}{2}$ miles northwest of Whig Lane, on the cross road to Avis Mills, shows gravel finer than that at the pits mentioned above. The gravel here has a strong resemblance to that of the Beacon Hill formation. A mile east of Point Airy is another pit (Fig. 17) showing 7 feet of gravel with occasional boulders of brown sandstone or quartzite. The constituents characteristic of the Bridgeton, that is the crystalline rock and the red shale, are present.

BETWEEN OLDMANS CREEK AND RACCOON CREEK.

Distribution.—The general relations of the Bridgeton in this area are shown in Fig. 18. The large area of Bridgeton to the southeast (about Hardingville in the section) is continued westward between the creeks to Fairview and Lincoln. West of that place, the continuity of the formation is interrupted by valleys. Considerable outliers occur north of Harrisonville, and smaller ones south and southwest of Swedesboro, the one farthest west being on Scull Hill.

The altitude of the Bridgeton surface about Fairview is 140 to 150 feet, and the top of Scull Hill is 146 feet. The remnants between these places are on hills of similar altitudes. Here therefore the base of the formation does not decline toward the Delaware.

Fig. 17.

Bridgeton gravel 1 mile southwest of Harrisonville, Gloucester County. Shows characteristic alternation of beds of almost solid gravel with layers of coarse compact sand carrying a few pebbles.

In most places, the Bridgeton of this immediate region rests on the Miocene, but on Scull Hill it appears to lie on the Cretaceous. The base of the Bridgeton shows itself topographically on the slopes of many of the hills, especially where underlain by Miocene, in an increased angle of slope. This is because the Miocene beneath is somewhat less resistant than the Bridgeton.

A feature of the Bridgeton of this region is the presence in it of an occasional boulder of Miocene quartzite (locally known as "bull's head" boulders). These peculiar boulders are rather common south and southwest of Swedesboro, within a radius of 3 or 4 miles. At few other points are they so abundant. They are, however, wide-spread, and seem to point to extensive weathering and erosion of the Miocene after some parts of it had become indurated. Boulders of this sort exist as far east and south as Hammonton, Folsom, and Tuckahoe.

Exposures.—A mile northwest of Harrisonville, in the 134-foot hill, a gravel pit shows 12 feet of compact sand and gravel, more or less cemented. There are other exposures between this point and Mullica Hill to the northeast, and Swedesboro on the northwest.

BETWEEN RACCOON CREEK AND MANTUA CREEK.

Distribution.—Between the upper courses of these creeks in the vicinity of Richwood (Five Points), the Bridgeton forms a nearly continuous mantle over older formations. About Glassboro and to the northwest the continuity is interrupted, as in corresponding situations farther south, being restricted at the east to the divides, farther west to the higher parts of the divides, as about Jefferson, and finally to the tops of isolated hills. The most northwesterly remnant is at Adams Hill, a mile or so east of Mickleton. The general relations of the formation between these creeks is shown in Fig. 19. This section corresponds, in all essential respects, with Figs. 16 and 18, farther south.

The relation of the Bridgeton to the Pensauken is well shown about Mickleton. The arkose phase of the Pensauken lies below 100 feet, and above this level Adams Hill rises to 133 feet, capped by an isolated remnant of the Bridgeton, which is litho-

logically very like the Pensauken, but topographically very distinct from it. Adams Hill corresponds topographically and in its capping of Bridgeton, to Big Mannington and Scull hills, already referred to. To the southeast, at Richwood, the surface rises to 176 feet. The thickness of the Bridgeton here appears to be nearly or quite 60 feet. ,

At Jefferson the surface of the Bridgeton has a maximum elevation of 166 feet, and its base an altitude of 120 to 130 feet; but this probably does not represent the full thickness of the formation as originally deposited. A mile and a half north of Pitman Grove, remnants of the Bridgeton appear at various levels between 120 and 150 feet, while the base ranges from 110 to 130 feet, and possibly even below the lower of these elevations at some points.

An uncertain patch.—A half mile west of Hurffville, west of Mantua Creek, is a hill having a summit altitude of 93 feet. There are gravel pits on the east side of this hill, showing a maximum depth of more than 20 feet of gravel, more or less cemented into conglomerate. The gravel contains shaly material.

This patch of gravel is one of the most puzzling in the entire area. It is much lower than the proper horizon of the Bridgeton, and is at the proper level for the Pensauken. On the other hand, the constitution of the material seems to put it with the Bridgeton, for the Pensauken of this region is not arkose, and does not contain red shale, unless this remnant is Pensauken. If it is Bridgeton, its base is considerably lower than that of any other remnant of this formation in this vicinity. If it is Pensauken, it is unlike any other Pensauken material in this immediate vicinity in constitution. It may be a deposit derived from the original Bridgeton, still retaining some of the soft materials characteristic of that formation, though not now in its original position, or it may be a mass of Bridgeton material displaced from its original position, at a time when the topography was very different from what it now is.

The base.—The base of the formation in the vicinity of Richwood is somewhat irregular, the observed range in altitude being from about 105 to 140 feet. The formation, which is

here gravelly, rests on characteristic fine Miocene sand, and the distinction between the two is therefore clear. In general, the base declines toward Edwards Run on the west, and towards Chestnut Branch on the east.

The base is much more regular about Cross Keys, Downer (about 150 feet), and Glassboro (about 140 feet) than about Barnsboro and Jefferson. In the vicinity of Barnsboro, indeed, it is evident from the base of the formation that there were pre-Bridgeton valleys leading westward toward the Delaware. The irregularities of base here are similar to those about Aldine (p. 27). There are also some irregularities in the base of the Bridgeton in the vicinity of Pitman Grove and Dilkesborough.

Exposures.—A mile or more northwest of Barnsboro, there are gravel pits, showing the nature of the Bridgeton at this locality. Some of the material is coarse, ranging up to boulder-size, and the gravel is compact. In some exposures, the gravel is confined mainly to the base, and in some places there is a conspicuous cobble bed in this position.

There is another exposure a third of a mile or so southeast of Barnsboro, on the Pitman Grove road, where 15 feet of Bridgeton gravel overlies the Miocene. There is rather less sand, loam, etc., associated with the gravel here than in most places, and the gravel itself is finer than is its wont. At Pitman Grove there are extensive exposures along the railway showing the base of the formation at an altitude of about 120 feet. Its base has the abundance of foreign material characteristic of the gravelly layer at the bottom. Boulders even 3 feet or more in diameter are to be found, though they are rare.

BETWEEN MANTUA CREEK AND BIG TIMBER CREEK.

Distribution.—Between the headwaters of these creeks, and between the upper parts of the south and north branches of Timber Creek, south of Point Pleasant, the Bridgeton formation is found in considerable areas at elevations of 150 to 170 feet; but northwest of Cross Keys it is found only on the divides (Fig. 20). Its most northwesterly remnant is on Irish Hill,

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north of the north branch of Timber Creek. Its general relations are shown in Fig. 22, which is slightly diagrammatic and slightly composite, since it brings in hills which lie a little to one side or the other of a straight line.

North of Davidstown, there are two areas within a mile of each other, covered with remnants of the Bridgeton formation. In both cases, it is thin and more or less cemented, and in both it probably represents no more than the base of the formation, which has escaped erosion.

Exposures.—Exposures are plentiful. A mile southeast of Green Tree, at the school house, 4 to 6 feet of gravel are exposed, similar to that of the Beacon Hill formation; but since it contains bits of red shale, it is regarded as Bridgeton. There is another exposure a mile northeast of Green Tree in the 166-foot hill, and several about Creesville. In the 125-foot hill three-fourths of a mile east of Hurffville, 7 feet of gravel characteristic of the formation are exposed between the levels of 110 and 120 feet. The gravel is very compact and more or less cemented, with a characteristic bed of coarse material, containing shale, at the base. Another characteristic exposure was seen in the 153-foot hill $1\frac{1}{4}$ miles northeast of Hurffville, where the partially cemented gravel contains pieces of red shale up to 4 inches in diameter; and another in the 134-foot hill, east of Mechanicsville. Other exposures occur in lower hills, where the correlation of the material is open to question.

Between Davidstown and Spring Mills, there are two hills which rise to the Bridgeton level (about 140 feet). In the more southwesterly of these hills, about a mile from Davidstown, there is a good exposure of the Bridgeton formation which contains more than the normal amount of coarse material, the boulders ranging up to 2 feet in diameter. They include a variety of sandstones, quartzose schists, conglomerate, and quartz. The base of the formation here has an elevation of about 130 feet. The character of the material is illustrated by Figs. 10 and 21 (pp. 16 and 42).

Base.—The base of the formation has an elevation of about 150 feet at Cross Keys, but declines to 135 feet at Green Tree. Still farther northwest, between Creesville and Hurffville, outliers

of gravel occur at lower levels, ranging down even to 105 feet. Some of them appear to be Bridgeton in situ, while others may represent displaced remnants of the formation let down a little from their original position. The most northwesterly remnant is $1\frac{1}{2}$ miles south by southeast of Woodbury, capping a 144-foot hill (Reservoir Hill). There is a considerable plain at about 100 feet surrounding this hill, and on the plain there is much gravel younger than the Bridgeton. The distinction of the two formations, topographically, is brought out in Fig. 20. Reservoir Hill corresponds with Adams Hill (Fig. 19) and Big Mannington Hill farther southwest. The base of the Bridgeton is lower about Creesville than elsewhere in the vicinity.

At Point Pleasant (Camden County), the formation is found up to levels of 191 feet, its base being about 15 feet lower. At Davidstown, Mechanicsville, and Irish Hill, it is at levels of about 140 feet, the altitude of its base ranging from 120 to 135 feet.

The distinctness of the Bridgeton and Pensauken is well shown about Irish Hill (Fig. 22). About Bell Mawr, the arkose phase of the Pensauken is restricted mainly to the 80-foot level. About Irish Hill, at the $100\pm$ level, there is Pensauken of the phase which occurs at a distance from the Delaware. Irish Hill, which has a Bridgeton cap, rises distinctly above these surroundings. The Bridgeton here is essentially the same in constitution as that about Point Pleasant, at elevations of 180–190 feet. It has all the characteristic Bridgeton marks, namely, arkose sand, shale, and bits of crystalline rock.

AREAS ABOUT BERLIN AND FARTHER NORTH.

Haddonfield.—About Berlin the Bridgeton caps the higher hills, but to the west there is an area of about four square miles where it forms a continuous cover. This area extends from Albion on the south, to a point a mile east of Gibbsborough on the north. The surface altitude ranges from 170 to 200 feet, and the base lies at elevations ranging from 150 to 200 feet. West of this area is the escarpment overlooking the broad low-

land along the Delaware. Six miles to the northwest of this escarpment, near Haddonfield, is an isolated hill (Fig. 23), the top of which has an elevation of 140 feet. This hill has a thin cap of gravel which is correlated with Bridgeton on topographic grounds, good exposures of the material not being seen. This is the only remnant of the formation between Gibbsborough and the Delaware.

The upper limit of the Pensauken formation about Haddonfield is about 120 feet. The isolated hill at 140, with its cap of gravel, is somewhat conspicuous. The gravel of this hill is not distinguishable, lithologically, from the Pensauken, but topographically the hill clearly belongs with Irish Hill 3 miles to the southwest, and with Adams and Big Mannington hills still farther southwest.

*Houghton's Hill.*¹—Two miles southwest of Marlton and 4 miles southeast of Haddonfield, is Houghton's Hill, which has a summit elevation of 181 feet. The gravel pit at its top shows 30 feet of Bridgeton gravel and sand (Fig. 24). The assortment of the material here is less perfect than in most sections of the Bridgeton formation. The larger part of the coarse material is at the base, where shale in pieces up to 2 inches in diameter is conspicuous. In the main part of the section, there is little loamy material, and the sand is less compact than is the habit of the formation. It consists of coarse sand and fine gravel, and makes fairly good road material, more because of the abundance of soft cherts, than for any other reason. The relations of this remnant are indicated in Fig. 24 (p. 40).

Albion.—North of Berlin the 214-foot hill has no Bridgeton at its summit. The hills of this elevation appear to have risen above the level of Bridgeton deposition, but they may not now have the altitude which they had during the Bridgeton epoch. About Albion, Bridgeton occurs at lower levels, perhaps as low as 150 feet; but south of Clementon the 202-foot hill seems to be free from Bridgeton material. The trace of gravel over it may have been derived from the Beacon Hill formation so far as present evidence shows.

¹On recent map of the Survey this is "Hutton's Hill."

Between Berlin and Atco.—The Bridgeton is present over a considerable area between Berlin and Atco, and is well exposed a mile northwest of the latter place. The material here is very like that at Pitman Grove, except that the sand is less arkose. Most of it appears to have been derived from the Cohansey formation.

ON THE DIVIDES BETWEEN BERLIN AND GLASSBORO.

The main divide between the Delaware and the ocean, in pre-Bridgeton time, appears to have extended from Daretown, via Whig Lane, Cross Keys and Mount Pleasant, to Berlin. Northwest of this main divide, the slope was steep and irregular; to the southeast it was gentler and less irregular. South of Berlin, the Bridgeton formation seems to have overspread this divide, where it was lower than to the north. Its failure to overspread it from Berlin to Freehold and beyond was probably because the divide was too high.

Lower land northwest of the main divide at the time of Bridgeton deposition is indicated by the decline in the base of the Bridgeton formation northwest of the escarpment, and by the numerous irregularities in its base in the vicinity of Green Tree, Pitman Grove, Barnsboro, Jefferson, and Aldine. These irregularities point to northwesterly drainage in pre-Bridgeton time. The lower land northwest of the divide appears to have been some 40 to 50 feet below the main divide.

IN THE AREA OF SOUTHEASTERLY DRAINAGE.

Southeast of the divide which limited streams flowing to the Delaware, the drainage appears to have gone directly to the ocean. The relations of the Bridgeton from Berlin to Glassboro are shown in Fig. 25, which is somewhat diagrammatic. It represents the Bridgeton as pinching out to the northeast, with the rise of the base on which it rests. The upper limit of the Bridgeton material about Berlin seems to have been about 200 feet. To the south and southwest, where the divide was lower, the

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land along the Delaware. Six miles to the northwest of this escarpment, near Haddonfield, is an isolated hill (Fig. 23), the top of which has an elevation of 140 feet. This hill has a thin cap of gravel which is correlated with Bridgeton on topographic grounds, good exposures of the material not being seen. This is the only remnant of the formation between Gibbsborough and the Delaware.

The upper limit of the Pensauken formation about Haddonfield is about 120 feet. The isolated hill at 140, with its cap of gravel, is somewhat conspicuous. The gravel of this hill is not distinguishable, lithologically, from the Pensauken, but topographically the hill clearly belongs with Irish Hill 3 miles to the southwest, and with Adams and Big Mannington hills still farther southwest.

Houghton's Hill 1 m.

Between Berlin and Freehold—The Bridgeton is present over a considerable area between Berlin and Freehold and is well exposed a mile northwest of the latter place. The material here is very like that at Pleasant Grove except that the sand is less arkose. Most of it appears to have been derived from the Cohansey formation.

ON THE DIVIDES BETWEEN BERLIN AND GLASSBORO.

The main divide between the Delaware and the ocean, in pre-Bridgeton time, appears to have extended from Daretown, via Whig Lane, Cross Keys and Mount Pleasant, to Berlin. Northwest of this main divide the slope was steep and irregular; to the southeast it was gentler and less irregular. South of Berlin the Bridgeton formation seems to have overspread this divide, but it was lower than to the north. Its failure to overspread from Berlin to Freehold and beyond was probably because the divide was too high.

Lower land northwest of the main divide at the River Bridge is indicated by the decline of the land. This is partly because the Bridgeton formation northwest of the divide is thinner than its thickness of the

an elevation of
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or so at Daretown.

of the formation from
boro to Freehold. The
Rosenbaum, Daretown
Union Grove
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of Berlin
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Bridgeton was thicker (50 to 70 feet about Richwood, Whig Lane, and Daretown).

The character of the Bridgeton is well shown in numerous exposures between Berlin and Glassboro. There is a large pit at West Berlin (altitude 180 feet) which shows 7 or 8 feet of coarse arkose sand with a little gravel, very compact, and available for road material. At the base of the section, crystalline material and shale appear in a layer 6 inches to a foot in thickness. Lumps of clay rounded into the form of pebbles appear in the same layer. A mile north of West Berlin there is another pit, at an elevation of 180 feet, which shows 10 feet of material like that at West Berlin. The exposure in Houghton's Hill has been referred to already.

WEST OF COHANSEY CREEK.

The Bridgeton formation is well developed on the divide west of Cohansey Creek, from Aldine to the scarp a mile or so south of Roadstown. It also covers the divides between the tributaries to Cohansey Creek, extending nearly to the main stream southeast of Cohansey, east of Shiloh, and northwest of Bridgeton. It extends westward on the divide between the headwaters of the tributaries of Stow Creek. Its base has an elevation of about 100 feet at the north, and 90 feet at the south, and its presence is nearly universal where the surface rises to the proper level. Its surface has a maximum elevation of 149 feet a fraction of a mile southeast of Cohansey.

Fig. 26 is a section from Aldine south through Friesburg, Cohansey, Harmony, and Shiloh, and shows the relations of the Bridgeton west of Cohansey Creek. The section is along the divide between the Cohansey and the Delaware drainage. The surface of the formation declines a little to the southward, and its base declines from 120 at Aldine to 80 or so at Shiloh, a slope of about 3 feet to the mile. Its thickness here is greater than in most other places, being as much as 30 feet in many places.

Fig. 26 represents the Bridgeton as terminating to the south, just south of Bowentown, at an elevation of about 80 feet, along

the line of an abrupt scarp which overlooks Delaware Bay. It is evident that the material did not terminate this way originally. Its original slope, continued southward, would carry it down to an altitude of about 40 feet near the shore of the present bay, and its original southward extension has probably been removed by erosion.

The scarp from Port Norris to Salem was doubtless developed in post-Bridgeton time.

BETWEEN COHANSEY CREEK AND MAURICE RIVER.

Distribution.—This area lies between Daretown and Elmer on the north and Dividing Creek and Newport Station on the south. The Bridgeton formation covers the higher parts of this divide generally, especially at the north (north of Bridgeton and Rosenhayn). To the south it is more patchy, where smaller continuous areas of the original divide remain. The short tributaries of Cohansey Creek have cut through the formation near the main valley only, while the larger tributaries of the Maurice River have dissected it much more extensively. This is partly because of the greater size of the Maurice River and its tributaries, and partly because of the lesser original thickness of the formation in the basin of this stream.

At the north, the base of the formation has an elevation of 110 to 120 feet, but it declines to about 90 feet or a little less in the latitude of Bridgeton, and to 60 feet or so at Dividing Creek Station.

Fig. 27 shows the general relations of the formation in this region, or, more exactly, from Barnsboro to Port Norris, along the line passing through Centerton, Rosenhayn, Carmel, Center Grove, and Dividing Creek. From Union Grove southward, the Bridgeton appears in isolated areas only, capping the divides. Had the section been located west of Elmer, through Deerfield and Woodruff, more of the formation would have appeared.

The section shows that the base of the Bridgeton is marked by slight irregularities, but the great fact is its decline to the southward from about 140 feet in the vicinity of Elmer, to 60

or 70 feet at Dividing Creek, a slope of 2 to 3 feet per mile. This decline is slightly less than that to the southeast.

The most notable irregularity of the formation, apart from the irregularity of base at Barnsboro, appears in the 124-foot hill south of west of Carmel, where the formation, as mapped, occurs higher than in its surroundings. The relations in the 124-foot hill here are similar to those in the 176-foot hill at Richwood, except that at the latter place the base of the formation is not higher in the hill than about it, while at Carmel it is. It may be that the gravel about the 124-foot hill at Carmel, mapped as Bridgeton, is really older. The irregularity of base, however, even regarding the gravel and sand about the hill as Bridgeton, is no greater than in some other places.

The formation appears to have its maximum thickness in the vicinity of Richwood, where erosion has been least; but its greater thickness here does not necessarily mean greater thickness originally.

Exposures.—The Bridgeton is well exposed in the vicinity of Aura (formerly Unionville), Harding, and Monroe. Still Run (near Aura) has removed much of the formation, and the remnants are thin, coarse gravel being common. It is probable that the coarse material was in the base of the formation originally.

There are gravel pits west of Monroeville, and exposures are found along the stream north of the village. The stream bank shows the base of the Bridgeton at an elevation of about 110 to 115. The gravel in this region is rather loose for the Bridgeton, and contains some shale.

A mile west of Monroeville, a pit shows 9 feet of Bridgeton, the upper 2 feet being gravel, sand, and loam, and the lower 7 feet highly colored compact gravel with some sand. Large pebbles and cobbles are rare, though present. Quartz and chert make up the body of the gravel, but there are some pieces of sandstone and a little shale.

Half a mile south of Monroe Station the Bridgeton is only 3 to 5 feet thick, and overlies glass sand. A mile southwest of the station there are several boulders, one of "bull's head" type $1\frac{1}{2}$ feet in diameter.

The Bridgeton is well exposed in the vicinity of Elmer, particularly along the stream south of the village. In Jones' pit, west of Elmer, red shale is abundant in the gravel, but there is much less of it in the exposures south of Elmer. Coarse material at the base of the formation is common here, and in many places carries boulders 1 to 3 feet in diameter.

There are several gravel pits in the vicinity of Palatine, especially along the bank of the stream, and in the vicinity of Upper Neck, on the east side of Muddy Run. Good exposures are to be seen, also, about Centerton and Finley. At the latter place there is a large pit on the railroad showing 20 feet of Bridgeton gravel and sand, overlying the Cohansey sand which carries laminæ of clay.

About Rosenhayn, a little Bridgeton gravel and sand overlie the Cohansey clay, which is here used for brick. A mile east of Rosenhayn, the railway cut at 90 feet shows Bridgeton over Cohansey. The former carries boulders 1 to 2 feet in diameter, crystalline rock and sandstone both being represented.

Other exposures occur in the 134-foot hill southwest of Carmel, and in the vicinity of Gouldstown and Fairton. The sand and gravel are cemented in some places. The Cohansey, parts of which are of coarse sand in this vicinity, is sometimes hard to distinguish from the Bridgeton.

Near Cohansey Creek, the Bridgeton has been largely removed, but the coarser materials which characterize its base remain in abundance on the surface. Some of them are large. Two miles south of Fairton there is a boulder of quartzite 2 x 2 x 5 feet, and boulders of Miocene quartzite are common.

In the vicinity of Center Grove it is difficult, if not impossible, to distinguish the Bridgeton formation from the Pensauken. About Cedarville, arkose gravel and sand, probably Bridgeton, overlie the glass sand of the Cohansey formation. The gravel and sand have the general constitution of the Bridgeton, with the bed of coarse gravel or cobbles at the base in many places. A mile south of Cedarville there is a large glass-sand pit (Cohansey) at a level of 30-40 feet. This has a cover of 3 to 8 feet of sand younger than Bridgeton, and in contrast with it.

Many of the shallow exposures of this area show a sandy surface, with gravel below, but they do not go below the zone of weathering, and are therefore not very instructive.

Other exposures of the Bridgeton occur west of Dividing Creek Station, along the railway and northeast of the station, where the sand and gravel are cemented in places. Bits of gneiss occur in the conglomerate. Other exposures appear in the vicinity of Baileytown and Buckshutem, where bits of shale and gneiss may be seen with the arkose sand. Another good exposure is found 2 miles south of Millville, where there is a deep pit worked for "core" sand. The upper part is Bridgeton and the lower part Cohansey, the two not being easily distinguished. Other good exposures occur in pits a mile southwest of Millville, on the Cedar Grove road (Fig. 28), and another at Mulford's Pit, less than a mile south of the last. Sixteen feet of Bridgeton material was here exposed. Extensive working had allowed the accumulation of boulders in the bottom of the pit. They ranged from 1 to 4 feet in diameter, and all were of sandstone and quartzite. The gravel here contained pebbles of clay.

BETWEEN MAURICE RIVER AND GREAT EGG HARBOR RIVER.

Between Maurice River and Manantico Creek.—The largest areas of the Bridgeton in this area appear on the uplands about Vineland, mostly above an elevation of 90 feet. The formation here is covered with eolian sand in many places. As the streams cut down through it into the Cohansey beds beneath, abundant sources of sand for the wind to transport were opened up. The smaller areas of the Bridgeton are more commonly covered by sand than the larger ones.

Numerous gravel pits and road cuts are found in this vicinity. In South Vineland there are pits opened for clay and glass sand, both of which are from the Cohansey; but over the sand and clay there is Bridgeton gravel and sand in most places, ranging up to 12 feet in thickness.

The general relations of the Bridgeton here are the same as at Downer, 15 miles to the north, and its constitution is essen-



Fig. 28.

Bridgeton formation near Millville, Cumberland County. Note the general fineness of the material.

tially the same, except that bits of shale and crystalline rock become fewer to the south, and the gravel becomes finer. The basal bed of coarse material is generally present.

The base of the formation here has some irregularities of a small sort. Thus south of South Vineland and east of Clayville, at the clay pits of the Globe Fireproofing Company, the surface of the Cohansey formation was seen stripped of the Bridgeton which once overlay it. The surface of the clay was marked by numerous depressions, some of which were like shallow gullies, and some were shallow depressions without outlets. Their forms suggested scour holes developed by running water, or, in some cases, depressions made by the overturning of trees. There are irregularities of other sorts, indicated by the fact that the altitude of the base of the Bridgeton varies 30 feet or more within the distance of a mile. This was seen in the vicinity of Clayville. Irregularities of base were also observed about Millville.

Between Manantico Creek and Manumuskin Creek.—A small area of the formation appears 2 miles southwest of Richland, a larger area on the divide between Hanges Bridge and Bennetts Mill, and several smaller areas on the summits south of Cossa Boone's Branch. The surface of the formation declines from a maximum of 120 feet at the north, to 70 at the south, and the decline of the base is from about 90 feet at the north to 60 feet at the south. The slight exposures show no distinctive features. The Cohansey sand in this vicinity is cemented in many places.

Between Manumuskin Creek and Tuckahoe River.—The Bridgeton appears on the divide between these streams most of the way from Richland to the latitude of Fries Mills. Farther south there are smaller areas on the upland east of Manumuskin and Bricksboro. As in the preceding cases the altitude is greatest at the north and least at the south, the decline being from about 90 feet at the north to about 50 feet at the south. About Richland and Doughty's the formation is orange-colored sand and gravel, with occasional cobbles, cemented in some places. The surface of the formation is more or less covered with eolian sand.

South and southeast of Bennetts Mills there are exposures at 70 to 100 feet. The material is generally more sandy than typical Bridgeton material farther northwest, though normal for this region.

At Hesstown, 7 miles southeast of Millville, there is an exposure in the 94-foot hill, showing arkose sand and gravel, with a cobble bed at the base.

Between Tuckahoe River and Egg Harbor River.—Between these streams the Bridgeton formation covers the low uplands, ranging in elevation from 70 feet or so near Mays Landing, to 40 feet, 3 miles north of Tuckahoe. South of Walker Forge, between South River and Stephens Creek, there is a considerable area of the formation, well exposed in the 71-foot hill south of the Forge. The base of the formation has an altitude of about 60 feet, and is cemented to conglomerate to some extent. Numerous other exposures occur on the road from Walker Forge to Estellville. They show repeatedly a thin cobble bed at the base, cemented in some places.

Southwest of Estellville there is a considerable area of Bridgeton on the divide between Tuckahoe River and Stephens Creek, and between Tuckahoe River and Pole Bridge Branch, centering about Russia. The gravel of this area is more compact and loamy than in the area to the north; otherwise it is essentially the same. That is, quartz and chert are the dominant materials, with cobbles 3 to 6 inches in diameter abundant in some places and rare in others. The gravel is cemented locally.

The general relations of the Bridgeton in this region are shown in Fig. 29, which extends from the vicinity of Green Tree to Tuckahoe.¹ The relations are much like those shown in Fig. 5. The thickness of the Bridgeton along the line of Fig. 29 is nearly uniform, but slightly greater at the northwest, near Green Tree.

The formation is well exposed at Buck Hill, about 3 miles north of Tuckahoe. The section is 6 to 12 feet deep, and the material coarse, orange-to-brown sand of arkose type, with scattered pebbles and beds of gravel. A bed of coarse gravel

¹ Figures 29, 30, 32, 33 are shown on Plate B, facing page 54.

lies at the base, on the Cohansey sand. Boulders up to 3 feet in diameter on the floor of the pit apparently came from this basal bed. The largest boulders are of brownish sandstone, of a type common throughout southern New Jersey.

The low altitude of this gravel and sand at Buck Hill raises the question whether it is not younger than Bridgeton. So far as its position is concerned, it might be Pensauken, or even Cape May; but at this locality, there are slabs of shale, even up to 2 feet in diameter, at the base of the formation, in precisely the same relations as at Folsom. This material, in this position, is so distinctive as to point strongly to its correlation with that at Folsom. Similar materials have never been found in the Cape May formation, or in the Pensauken formation southeast of the Amboy-Bordentown-Delaware valley lowland, if present correlations are correct.

The character and condition of the Triassic slabs at Buck Hill is such as to preclude the idea that this material has been re-worked since its deposition. The general character of the formation is such as to rule out the Cape May formation at sight. This youngest of the Coastal Plain formations is everywhere composed of fresh, undecomposed material, whereas the decayed condition of everything that will decay is conspicuous at Buck Hill. Furthermore, the altitude of the gravel at Buck Hill is in keeping with the altitude of the Bridgeton to the northwest where it is characteristically developed. The same formation occurs at various intermediate points at harmonious levels, as at Russia, Doughty's, Richland, Newtonville, and Williamstown. In other words, if we project a line from Cross Keys at 150 feet, to Buck Hill, at 40, it will correspond closely with the base of the Bridgeton at all intermediate points.

Between the headwaters of Maurice River and Great Egg Harbor River.—Maurice River has its source near Glassboro and Cross Keys and flows to Delaware Bay at Port Norris. Great Egg Harbor River has its source a few miles farther northeast, near Berlin and Williamstown. In the area between the upper parts of these drainage systems, north of the headwaters of the Manantico and Manumuskin creeks, there are

considerable areas of the Bridgeton formation, as about Williamstown, at elevations above 140 feet, about Blue Bell at elevations above 120 feet, about Newtonville at elevations above 100 feet, about Richland at elevations of about 90 feet, and at lower elevations to the southeast.

At Williamstown a gravel pit at an elevation of 160 feet, on the north slope of the 164-foot hill in the northwest part of the village, shows 10 feet of gravel. The structure of the upper part is very irregular, but the lower part is well stratified in nearly horizontal beds. The lower part is arkose, coarser than the upper part, and contains less loam. Pebbles and bits of rock more than 1½ inches in diameter are rare, though occasional cobbles are present. Shale was not seen, but there are pieces of crystalline rock of the Philadelphia gneiss type (mainly of quartz and mica).

South of Williamstown, there are numerous shallow pits and cuts which show gravel and sand similar to that at Williamstown, but shale and crystalline rock are not seen, and from the habit of the formation would not be expected in such shallow exposures as most of those of this region. The base of the gravel, the horizon in which these constituents are most abundant, is rarely seen. Coarse material of the size of cobbles is rather common in spots, as east of Janvier.

The base of the gravel was seen at several pits between Williamstown and Richland, with the Cohansey sand below. The coarse gravel and cobbles at the base are present in many places, but, as a rule, without shale and crystalline material.

About Richland, there are numerous exposures in cuts and pits. The Southern Railway of New Jersey makes a cut 10 feet deep, showing orange-colored coarse sand, with seams of gravel and occasional cobbles or larger pieces of rock.

From the main divide along which the section shown in Fig. 29 is taken, the Bridgeton cap extends out over some of the minor divides between tributary streams. It also caps certain isolated hills or small areas set off from the main divides by erosion. One of these minor divides extends east of Richland, between Deep Run and South River, both tributary to Great Egg

Harbor River. Others lie between South River and Stephens Creek, and between the last and Tuckahoe River.

On the divide east of Richland, between Deep Run and South River, the Bridgeton is somewhat wide-spread at an elevation ranging from about 100 feet at Richland, to about 60 at Emmelville. In the same distance, the base of the formation declines from 80-85 feet to 55-60.

Exposures near Emmelville show 4 to 6 feet of gravel similar to that at Williamstown, except that it is more commonly cemented by iron oxide. The material is, indeed, quarried as much as dug. No shale or crystalline rock bits were seen here, and the correlation of the material with the Bridgeton is not made with great confidence.

The divide between Richland and Mays Landing shows a few exposures deep enough to be significant. The railway cuts show but a thin remnant of the Bridgeton. What appears to be the basal part of the formation is partly cemented to conglomerate which is locally in place and locally broken and displaced. The Cohansey appears to be but little below the surface.

Between Buck Hill and Cross Keys, shale and bits of crystalline rock are not seen in many places, though exposures are not rare in the vicinity of Russia, Richland, Newtonville, and Williamstown. These same materials are found on both sides of the line of the section, as at Downer, Folsom, and Millville.

If the section along the line of Fig. 29 be considered, the altitude of the surface of the formation ranges from 177 feet at Cross Keys, to 56 feet at Buck Hill. This represents a slope of about 4 feet a mile for the upper surface along this line. The base of the formation is more regular than the surface, but the general slope is in the same direction and about the same in amount. At Cross Keys, the base has an elevation of about 150 feet, and at Buck Hill of about 40 feet. The irregularities of base are such as would be expected from deposition on a surface of slight relief, developed by stream erosion.

BERLIN TO ATLANTIC CITY.

Distribution.—Fig. 30 shows the relations from Berlin southeast to Atlantic City. The section is extended northwest of Berlin, and takes in Houghton's Hill, which is somewhat out of line. The line of the section is along the divide between Mullica River and Great Egg Harbor River, where remnants of Bridgeton are considerable. The formation has been removed from the basins of these streams, except on the crests of isolated hills; but the remnants are so disposed as to leave no doubt that they are parts of a once continuous formation (p. 64).

About Hammonton, the base of the formation has an elevation of about 110 feet, but as everywhere else, it declines to the southeast. At Elwood its base is down nearly to 80 feet, and at Egg Harbor City nearly 20 feet lower. Between Hammonton and Egg Harbor City, it is found on divides only, and covers a relatively small part of the total area. It is well developed about Hammonton, especially to the south, in a small area at Banard Station, and on the more conspicuous elevations east of Da Costa, and over much of the area between Elwood and the western border of Egg Harbor City. Small areas occur 3 or 4 miles northeast of Elwood. Another small area to be mentioned is that southwest of Folsom, at an elevation of about 90 feet. In much of this area the formation is thin, and represents the base of the formation only.

Constitution.—Lithologically the formation is a unit from Berlin to Pleasantville, though not without variations. The coarse arkose sand, the bits of Triassic shale and crystalline rock, and the structure remain much the same throughout; but the distinctive red shale and the bits of crystalline rock become less abundant to the southeast. They become so scarce, indeed, that they do not appear in every exposure, especially if the base of the formation is not seen. It is to be remembered that bits of shale and crystalline rock are rare at some points well to the west, as at Williamstown Junction and Blue Anchor. In general, too, the Bridgeton material becomes finer to the southeast.

Exposures.—Good sections have been seen in the railway cut at the sanitarium near Hammonton, where the distinctive features of the formation are well shown, and in the railway cut at Folsom, 3 miles southwest of Hammonton. At the last locality, the foreign constituents (shale, schist, etc.) are especially abundant, and in large pieces (Fig. 9).

Exposures are common east and south of Hammonton in gravel pits and road cuts. Many of the cuts are in the Cohansey sand beneath the Bridgeton, rather than in the Bridgeton itself. In some of the pits, only the upper part of the Bridgeton is exposed, because this part is more gravelly than that below, and more compact by reason of its content of loam.

At Elwood the exposures show the same features with a coarse layer at the bottom at many places. A good exposure was seen $1\frac{1}{2}$ miles northeast of Elwood, on the road to Batsto, in the 121-foot hill. Here $5\frac{1}{2}$ feet of compact gravel of quartz and chert overlay $2\frac{1}{2}$ feet of loamy gravel.

About Egg Harbor City and farther east, the separation of the Bridgeton formation from the Pensauken becomes uncertain, for the gravel and sand concerned sink to low levels and are well exposed in but few places.

In the vicinity of Pomona and Pleasantville, there are large areas of gravel with greater thickness, which are perhaps Bridgeton. There are good exposures in road-gravel pits 1 and 2 miles southeast of Pomona Junction, and also on the P. and R. R., a mile north of Pleasantville, and near Farmington Station. The exposures between Pomona and Pleasantville show 5 to 10 feet of Bridgeton material. In its general character it is typical of the formation, except that shale and crystalline material are wanting. The abundance of soft cherts is one of the features which suggest its Bridgeton, rather than Pensauken age. This chert must have been hard when deposited, and the decay is subsequent. The upper part of the formation here has more gravel and loam than the lower part, and less sand. The stratification is much more distinct and more regular in the lower part than in the upper. This point, alone considered, suggests a marine, rather than a fluvatile origin.

Base.—Northwest of Berlin, the Bridgeton base has an elevation of about 200 feet. Thence it declines southeastward to 160 feet at Wilton, 140 feet at Blue Anchor, 110–120 feet at Hammonton, about 100 feet at Da Costa, 80 feet about Elwood, and 60–70 feet at Egg Harbor City and Pleasantville.

The correlation of the Bridgeton at the southeast is somewhat uncertain, and its separation from the Pensauken may be questioned; but the decline from Berlin to Elwood, if continued, would bring the base of the formation down to the level indicated, at Pleasantville. The constitution of the sands and gravels at the higher levels near Pleasantville is consistent with this interpretation. If the gravels and sands of the higher levels about Pleasantville are Bridgeton, the base of the formation declines about 150 feet in 36 miles, giving it a dip of a little more than 4 feet per mile.

The base of the formation shows some irregularities, but they are of a small sort, and in keeping with those farther northwest.

THE WOODMANSIE PHASE.

Several cross sections from northwest to southeast, across the Coastal Plain, illustrate the general relations of this phase of the formation.

ARNEYS MOUNT TO TUCKERTON.

Distribution.—The area through which this section (Fig. 32) runs is mostly in the basins of Mullica River and Rancocas Creek, the two largest streams of the Coastal Plain in New Jersey. The area from Arneys Mount to Apple Pie Hill (near Harris Station) is in the drainage basin of Rancocas Creek, while the area southeast of Apple Pie Hill is in the basin of Wading River, a tributary of the Mullica River. The section is extended to the vicinity of Kinkora on the Delaware.

The conspicuous features of the section are (1) the broad lowland to the northwest, near the Delaware, (2) Arneys Mount and Apple Pie Hill, and (3) the upland at Munion Field near the ocean.

Arneys Mount is capped with Cohansey sand. Apple Pie Hill has a few feet of gravel, which is regarded as a remnant of the Beacon Hill formation. The gravel is of quartz and chert, in proportions of about 4 to 1, with a little sandstone and quartzite. If the Beacon Hill formation once covered Arneys Mount, as it probably did, it was at a level higher than the top of the present hill. Scattered pebbles of Beacon Hill type on the crest of the hill suggest such a former covering.

A plain from Apple Pie Hill (208 feet) to Bear Swamp Hill (165 feet), and to another 147-foot hill to the southeast, would, if carried northwest, have an elevation of about 250 feet at Arneys Mount (20 feet above its top). This probably represents about the appropriate level of the former Beacon Hill cap here. Carried southeastward, such a plain would have an elevation of 140 to 160 feet at Munion Field, and this is probably the approximate Beacon Hill level of that region.

Fearings Hill (about 2 miles northwest of Fountain Green) has about the same altitude as Houghtons Hill. Its gravel cap has the same topographic relations as the gravel on Houghtons Hill (Fig. 24), Point Pleasant (Camden County) (Fig. 22), and Jacobstown (Fig. 33), and is referred to the Bridgeton formation. The gravel itself is not of such a character as to give especial force to this correlation.

Northwest of Apple Pie Hill (South Park) there are gravel beds 4 to 10 feet thick, at an altitude of about 140 feet, which probably are Bridgeton (possibly Pensauken). The same may be said of the gravel about Munion Field at elevations of about 120 feet.

Some of the features of these gravels which seem difficult of explanation are probably connected with the shifting of the main divide of the region from near Arneys Mount, to its present position, near Apple Pie Hill.

Constitution.—The gravels at South Park, at an altitude of about 140 feet, and in the vicinity of Bear Swamp Hill, at 120 to 160 feet, consist mainly of quartz and chert, but they contain bits of ironstone, which seems to rule them out of the Beacon Hill formation. The absence of the ironstone, so far as ex-

posures show, and the abundance of the soft chert at Apple Pie Hill, together with its topographic position, seem to place the gravel of that place with the Beacon Hill formation, though the correlation is less decisive than could be desired.

In the Beacon Hill formation the cherts are weathered characteristically. The chert pebbles seem to be made up of an irregular network of harder and more insoluble material, filled in with less durable material. On weathering, the less resistant parts become whitish powder, while the skeleton remains hard. At the surface, the decayed part is carried away and the skeleton remains. In secondary gravels derived from the Beacon Hill, the old networks are more or less broken and worn. Occasional fossils in the chert point to its origin from Devonian formations.

The quartz in the gravel is vein quartz largely. On weathering, the pebbles develop a columnar structure. This may go so far that the little columns separate from one another. Some of the pebbles may be crushed in the hand, even when their outer forms are still perfect. In gravels derived from the Beacon Hill gravel, there are splinters from these pebbles of columnar structure, but decayed pieces of quartz are much less common than in the original Beacon Hill formation.

In the vicinity of Tuckerton, the section shows gravel and sand interpreted, though not without reservation, as Pensauken. No facts concerning these sands and gravels are known which would preclude their deposition by streams or by the ocean. Since they were deposited, the ocean has doubtless encroached on the shore, carrying away the shoreward part of the formation as originally laid down within the limits of the State.

Correlation.—From the foregoing it is apparent that the basis for correlating any gravel and sand along the line of this section with the Bridgeton formation, is rather insecure. Such correlation must be based on topography more than on anything else. It is to be noted that the possible Bridgeton beds at 160 feet at Bear Swamp Hill, and at 126 feet at Munion Field, are considerably nearer the ocean than the areas of Bridgeton at corresponding levels in other sections. So far forth, this would suggest the greater (pre-Bridgeton) age of these gravels.

The highlands at 140 to 160 feet, near Tuckerton, are nearer the ocean than areas of similar altitudes to the west. But if the sea has encroached notably on the land in this vicinity, the deposits at Munion Field are nearer the shore than they were at some earlier time. If the Delaware be taken as the base line of comparison, Munion Field is 38 miles from it, while Waterford, Williamstown and Glassboro, where the Bridgeton formation has a similar altitude, are less than half as far from the river. The Bridgeton (?) gravel at 140 feet at South Park, near Apple Pie Hill, is about the same distance from the Delaware as the Bridgeton gravel at 140 feet near Williamstown, Glassboro and Elmer. If, in pre-Bridgeton time, the Mullica River had its head near Arneys Mount, and developed a broad valley plain sloping to the southeast, the 144-foot level at South Park would be the appropriate level for gravel accumulation. But if the 144-foot level is the proper Bridgeton level at South Park, 140 feet at Munion Field would be too high. This tract appears to have been a relative highland in Bridgeton time, and to have escaped much deposition above 120 feet. Such gravel as there is here at the higher levels may have been left in the course of the degradation of the region from an older and higher level.

ELLISDALE TO BARNEGAT.

The section shown in Fig. 33 is nearly parallel to the last, but is along the divide between Mullica River and Toms River at the southeast, and across the basins of Crosswicks Creek and Rancocas Creek at the northwest. The section is extended northwestward through Allentown to the vicinity of Pennington. It brings in some points which are somewhat out of line, and omits many minor irregularities of surface; in other words, it is somewhat generalized. The topographic distinctness between the Pensauken gravel and the Bridgeton gravel is well shown in this section (Allentown and Jacobstown).

The conspicuous features of the section are the highlands in the vicinity of (1) Ellisdale and Jacobstown, and (2) Woodmanzie and Old Half Way.

The 229-foot hill at Ellisdale corresponds with Arneys Mount of the preceding section, while the highland at Woodmansie corresponds in some sense with Apple Pie Hill. In keeping with these suggested correspondences, the gravel at Woodmansie is correlated with the Beacon Hill formation, while that southeast of Woodmansie, that at Millville (Ocean County), and that at Barnegat, appear to be younger.

The top of the hill at Ellisdale is Kirkwood or Cohansey sand. It is below the level at which the Beacon Hill formation would be expected in this immediate region. The base of the Beacon Hill gravel is at 360 to 375 feet above Crawfords Corner, 340 to 360 feet at Clarksburg, and 330 feet at Stone Tavern. If the base of the formation continued to decline southwestward at this rate, it should lie at about 300 feet at Ellisdale, and 280 feet at Arneys Mount (see p. 51). If the proper elevation for the Beacon Hill gravel at Ellisdale and Arneys Mount be estimated from remnants to the southeast, the result is about the same. The Ellisdale Hill is also too low for the Bridgeton in this region, for while the data are imperfect, the restoration of the pre-Bridgeton surface as a plain ranging from 250 feet at Ellisdale, to 200 feet at Woodmansie and 150 feet at Barnegat, seems to be indicated from such data as bear on the point.

The Ellisdale-Jacobstown elevations are parts of the old divide between the Delaware drainage and the ocean drainage. The headwaters of Crosswicks Creek have worked back, capturing the tributaries of the streams that formerly flowed to the ocean, and leading them by a circuitous route through the Cream Ridge gap, westward to the Delaware.

Topographically, the hills at Ellisdale and Jacobstown go with the Clarksburg hills, and the gravels at Jacobstown are, therefore, the topographic equivalent of those at Glassboro and Daretown, and are older than the Pensauken formation.

Though the topographic equivalent of gravels at Glassboro, the gravels of Jacobstown are not arkose, and they contain detritus from the Cretaceous as well as from younger beds. Since the gravel at Jacobstown contains Cretaceous material, it must be assumed that the streams which deposited it (assuming



it to be a stream deposit) flowed from the northwest to the southeast. These gravels are now 15 feet or so higher than the outcrops of the highest Cretaceous beds in the vicinity. At Ellisdale, a few miles away, the Cretaceous outcrops at altitudes up to about 200 feet. Outcrops of the same beds farther northwest would have been higher, and such outcrops northwest of Jacobstown (now worn much lower) may well have been the source of the Cretaceous material in the Jacobstown gravel, if streams flowed to the southeast from them.

From the present topography, it is inferred that Toms River once had tributaries reaching northwestward past Prospertown to Clarksburg. Either Toms River or Mullica River probably had branches as far northwest as Ellisdale at least. On the supposition that the drainage was to the southeast, it is therefore not difficult to account for the Cretaceous material in the Jacobstown gravel.

The gravel at 140 feet at Barnegat seems best correlated with the Bridgeton formation, and if this correlation is correct, the gravel a few miles south of Staffordville, at about 100 feet, may be Pensauken.

A few areas of gravel not on the line of the section merit notice. One of these is south of Jacobstown, where gravels which belong with those at Jacobstown decline to 170 feet or so at Springfield, and to about 150 feet at Fountain Green and Pointville. The gravel on Fearings Hill, west of Springfield and Fountain Green, is an outlier of the larger areas at these places. The gravel at Fearing Hill is regarded as a local phase of the Bridgeton, the same as that at Jacobstown.

West of Colliers Mills, there are areas of gravel at altitudes ranging from 160 feet to 208 feet. The 208-foot hill is $1\frac{1}{2}$ miles northwest of Colliers Mills on the Hornerstown road, and the 160-foot area a mile south of Colliers Mills. These remnants are along the divide between the headwaters of Toms River and Crosswicks Creek. The gravels here may be parts of a once continuous sheet, or remnants of deposits on an old valley plain.

Bordens Mill Branch, flowing past Colliers Mills, is a tributary of Toms River, and appears to have headed formerly in the

Clarksburg hills, and to have flowed through Prospertown, Archers Corner, and thence to the sea, as now. Ivanhoe Brook, which heads north of Prospertown, is perhaps the original head of Bordens Mill Branch, but it is now the head of Lahaway Creek, tributary to Crosswicks Creek. In Bridgeton time, the drainage probably went from Clarksburg south by way of Ivanhoe Brook, Prospertown, and Colliers Mills, to Toms River. When Crosswicks Creek cut across the marl highland at Cream Ridge, and entered the region of Hornerstown and New Egypt, the drainage of Lahaway Creek and Ivanhoe Brook was diverted to the Delaware. The gravel west of Colliers Mills at an elevation of about $200 \pm$ feet, was probably deposited by the stream which followed the course of Bordens Mill Branch in Bridgeton time, when the drainage from the Clarksburg region flowed to Toms River.

The gravel west of Colliers Mills is of local trashy material derived from the Beacon Hill and Cohansey formations. It contains nothing which can be referred confidently to the Cretaceous. The streams of the time had not yet cut through the Miocene of the Clarksburg region, and so had not access to older formations.

HIGH LEVEL GRAVEL AT HEAD OF WOODS.

From Head of Woods southeast to Whittings, there is a series of hills ranging from 160 to 200 feet in height, along the divide between Toms River on the one hand, the Rancocas and Crosswicks creeks on the other. Just south of Colliers Mills, at Head of Snag, there is a gap in this divide, at the 130-foot level. This is probably part of a valley occupied by a stream for a considerable time after the epoch of Bridgeton deposition. It is probable that the drainage from the vicinity of New Egypt, and possibly from the vicinity of Jacobstown, once went eastward by Head of Snag to Toms River, and that the drainage did not assume its present course until long after the Bridgeton formation was deposited.

At Boyds Hotel, near Whittings, there is a gap in the divide at the 150-foot level. This probably represents a portion of another old valley which extended far to the west or northwest.

The drainage of the region in the vicinity of Browns Mills, and possibly as far west as Arneys Mount, may once have gone east by way of Buckingham and Boyds Hotel, to Toms River.

This range of hills has but little gravel (1 to 5 feet), and that on the higher elevations. It seems to represent the last remnant of a gravel bed which once covered the whole area, and which was deposited on a plain of erosion developed after the Beacon Hill epoch. The region is thought to have suffered a degradation of 50 to 75 feet after this epoch, for the Beacon Hill formation originally extended over the region from Whittings to Head of Woods, at a level which is now about 250 to 275 feet above sea level.

GRAVELS (BEACON HILL?) ABOUT WOODMANSIE.

In the vicinity of Woodmansie there are many patches of gravel at various high levels. To the northward, at Whittings, they are at elevations of 170 to 200 feet; just east of Wheatlands, at a maximum altitude of 201 feet; east of Woodmansie, in the vicinity of Old Half Way, up to altitudes of 213 feet; south of Old Half Way and southeast of Woodmansie, up to 208 feet; 3 miles southwest of Woodmansie, near the railroad, up to 204 feet. There is, therefore, a considerable area within 5 miles of Woodmansie where the surface rises to an altitude of 200 feet at many points. These higher lands are usually capped with gravel. Its depth is rarely more than 5 or 6 feet, though in occasional pockets twice this thickness is reached. It would appear that the region was once quite generally but thinly covered with gravel at the level of 200 feet, and that the gravel patches now remaining are but remnants. There are numerous gravel remnants at slightly lower levels, some of which, at least, have been displaced downward since deposition.

The correlation of these gravels is not clear. They seem a little too low for Beacon Hill and a little too high for Bridgeton. They are farther southeast than Whittings, where the Beacon Hill gravels might be a little lower than to the north and north-west. They may include deposits of both epochs, especially if the erosion between the two epochs of deposition was here but

little. The upper part of the later deposit may be as high as the lower part of the earlier.

Apparently the Woodmansie area has suffered almost the minimum of erosion since Beacon Hill time. More than any other tract in southern New Jersey, it seems to have been avoided by large streams, since that epoch. There seems therefore to be no adequate reason for excluding these gravels from either formation.

In Bridgeton time, the Woodmansie upland probably extended farther northwest than now, toward Mt. Misery; but when Rancocas and Crosswicks creeks got their heads into this region, they degraded their basins faster than the Mullica River and Toms River degraded theirs.

CLARKSBURG TO ISLAND HEIGHTS.

Location of section.—The section shown in Fig. 34¹ represents the general topographic relations along the divide between Toms River and Metedeconk River, the headwaters of which are close together in the vicinity of Charleston Springs. Metedeconk River was once a larger stream than now, for some of its headwaters have been captured by Manalapan Brook and Millstone River. Its earlier source was probably in the Perrineville hills.

The section is somewhat composite and diagrammatic. It passes through the 354-foot hill a mile north of Clarksburg, and thence southeast nearly to Cassville. Here the 257-foot hill and others at about 190 feet, a little out of line, are brought into the section. Near Cassville the section is offset to the northeast about 2 miles, and is then continued southeastward, parallel to the Metedeconk River to Seven Stars, near Lakewood. From Seven Stars, it follows a line roughly parallel with Toms River, to Island Heights and thence to Berkeley. Some minor details are omitted.

To the northwest, the section is carried to Disbrows Hill, Hightstown, Dutch Neck, and Princeton, and the Rocky Hill

¹ Figures 34, 35, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54 are printed on one plate, opposite page —.

range, for the purpose of bringing out the relations of the Pen-sauken formation.

In this section the Beacon Hill gravel appears at one point only, namely, in the Clarksburg hills, where its base has an elevation of about 360 feet. This alone would give little clew to the surface in the Beacon Hill time, but from the sections of Figs. 34 and 35 (p. 136) more is known of it.

On the Rocky Hill range there is a meager scattering of gravel at levels between 300 and 400 feet. These traces of gravel are in accord with the hypothesis that the Beacon Hill formation once covered the ridge.

Bridgeton base southeast of Clarksburg.—The data for the reconstruction of the Bridgeton base along the line of this section leave much to be desired. Southeast of Clarksburg there is a series of elevations ranging from 250 feet near Carrs Tavern to 96 feet at Island Heights. The gravels on the hills, which range from an altitude of 190 feet near Francis Mills to 160 feet at Cassville and to 150 feet in the vicinity of Lakewood, are regarded as most probably of Bridgeton age.

The volume of material near Lakewood is much greater than at the 190-foot level at Francis Mills. Its elevation at Lakewood is 150 feet, more or less. In constitution it is very unlike the gravel near Clarksburg, but very similar to that at Barnegat, which is like that of Hammonton and Vineland, except for the absence of shale and crystalline material. The Lakewood and Barnegat gravels are alike in coarseness, proportions of sand and gravel, structure (for example, the long, horizontal lines of pebbles seen in section), compactness, color, cementation, etc.

From Lakewood to Island Heights, the surface declines from 150 feet to about 50 feet at Toms River. Most of the surface is covered with gravel. It is doubtful if all of it is of the same age, but the differentiation of its parts, if its parts are different, is difficult. The gravel at the lower levels carries more ironstone, etc., and less soft chert, relatively, than that at the higher levels. It is possible here, in various cuts, to recognize about the same distinctions, with reference to constitution, that obtain in the Bridgeton, Pen-sauken, and Cape May elsewhere. It seems prob-

able that these several formations here overlap one another; that is, that they are more or less imbricated.

Bridgeton base northwest of Clarksburg.—To the northwest of the Clarksburg hills, there is difficulty in identifying the Bridgeton formation and in determining the level at which it should occur. Between Disbrows Hill and Rocky Hill (Fig. 34) is the broad lowland covered by the Pensauken formation. Northwest of the Pensauken area there is a tract near Princeton, more than 200 feet in elevation. This elevation stands in about the same relation to Rocky Hill that Disbrows Hill does to the Clarksburg hills.

At an elevation of about 220 feet in the vicinity of Lawrenceville southwest of Princeton, patches of gravel are found. They are too low to be correlated with the Beacon Hill gravel, and too high for Pensauken, and for these reasons are regarded as probably Bridgeton remnants.

Near Pennington, 7 miles west of Princeton, there are boulders, gravel, etc., at elevations of 200 to 240 feet, and this level seems to represent a rather definite former plain of degradation. The boulders are regarded as probable remnants of the Bridgeton cover which once overlay the region.

Near Disbrows Hill, the section shows lesser hills at 160 to 180 feet. These hills are in reality a little south of Disbrows Hill, but the section shows their proper relations stratigraphically and topographically. Their gravel caps may be Bridgeton or post-Bridgeton, and their correlation is open to question.

The pre-Bridgeton surface southeast of the Clarksburg hills appears to have had an altitude of about 200 feet and to have declined to the southeast. This plain of degradation was probably developed by streams 25 to 40 miles in length. Northwest of the Clarksburg hills the pre-Bridgeton plain was probably developed by the great river which flowed through the Amboy-Bordentown valley, and by its tributaries. If this is so, the plain developed by this master stream should have been lower than the plains to the southeast developed by many small streams. The Delaware now has its bed down to tide level up to Trenton, 100 miles or so from the ocean proper. The larger stream of earlier

times may have been near tide level still farther from the sea. The pre-Bridgeton lowland on the northwest side of the Clarksburg hills, therefore, may well have been lower than the corresponding plain to the southeast. Its level near Hightstown may be inferred from the facts set forth in the following paragraphs.

1. In the vicinity of Blackwood and Haddonfield, there was a considerable area near the Delaware in pre-Bridgeton time, 40 to 60 feet lower than the major divide at Berlin and Glassboro. This lower land appears to have been a lowland or rude terrace bordering the ancestor of the Delaware. If this stream was at tide level at that time, this bordering lowland could not have been very much higher.

The present remnants of this lowland, as located by the base of the Bridgeton, have altitudes of about 100 feet at Woodstown, 120 feet at Woodbury, and 130 feet at Haddonfield. If these figures indicate the rise of this old lowland to the northeast, a surface projected from Haddonfield to Hightstown in accordance with this slope, would have an elevation of about 200 feet at the latter place; but without further evidence, it would be unsafe to assume that the plain of Bridgeton deposition at Hightstown was at this level. The data, however, do indicate that the pre-Bridgeton lowland rose to the northeast from the Delaware.

2. The 200-foot divide in the vicinity of Freehold apparently goes with the 140-foot surface at Glassboro beneath the Bridgeton gravel, and appears to be a part of the same plain sloping southward.

The lowland along the Delaware, in the vicinity of Barnsboro and Blackwood was apparently 40 to 60 feet lower than the plain at Glassboro and Daretown, farther back from the main stream. Similar relations appear to have existed in the vicinity of Freehold, and the Hightstown plain was perhaps 50 to 60 feet lower than the Freehold plain at 200 feet. If the remnants of the pre-Bridgeton plain at Freehold are now found at $200 \pm$ feet, the remnants of the pre-Bridgeton plain at Hightstown, if they exist, should be 50 or 60 feet lower.

By these two lines of approach, therefore, we seem to reach different conclusions with reference to the height of the Bridgeton plain at Hightstown.

Possible changes of level.—If the Glassboro phase of the Bridgeton formation is glacial outwash in part, it filled the broad valley from Amboy to Bordentown, and overspread the low divide below Berlin. On the lowland bordering the Delaware, some 50 feet of Bridgeton material accumulated, and 50 feet more on the divide at Glassboro. It would appear, therefore, that the Bridgeton material must have been something like 100 feet deep, at a maximum, on the lowland along the Delaware. The upper surface of the deposit at Haddonfield must have been at a level which is now somewhere about 200 feet above the sea, and there should have been a harmonious gradient from Hightstown toward Haddonfield sufficient to allow the transportation of material, if it came by way of the Hudson, and if relative levels have not changed since. This would bring the Bridgeton surface at Hightstown up to the supposed pre-Bridgeton plain of erosion at Freehold, about 200 feet; but this level at Freehold did not receive the glacial outwash. Therefore we must infer either that the preceding hypotheses are incorrect, or that the relative altitudes of the Freehold and Glassboro regions have changed. Evidence of relative change is found in the fact that the Bridgeton formation, reaching an elevation of 200 feet (present) at Berlin, appears not to have reached the 200-foot areas at Freehold, though the latter place is some 50 miles nearer the assumed source of the gravel. Allowing for the necessary gradient, it would seem that the Freehold region should have stood 100 feet or so higher than the Berlin region at this time, in order to have escaped deposition.

From data about Berlin, it is concluded that that region stood 80 to 100 feet lower in Bridgeton time than now. If this was the case, the Freehold region might have had an altitude similar to that of the present.

It is difficult to conceive what the attitude of the region was in Bridgeton time, in order to meet all requirements. If the region near Hightstown and Freehold was elevated at the be-

ginning of Bridgeton time, so as to give a steep gradient to the southwest, such elevation should have affected the streams flowing from Freehold to the ocean, unless the coast were correspondingly farther out. If the streams flowing to the southeast were affected by such an elevation, they should have deepened their alleys; but we find no evidence that the valleys were so deepened at this time. If, on the other hand, the region about Berlin subsided while the region at Freehold remained 100 to 150 feet above tide, there might have been sufficient grade to carry material from Hightstown to Berlin.

A possible explanation of the difficulties is found in the position of the coast line in the Bridgeton period. The eastern coast suggests that it has been encroached upon by the sea in post-Bridgeton time. From Toms River north, it probably lay much farther east in the Bridgeton epoch than now. If the coast line were some 30 miles east of the present coast in the vicinity of Asbury Park and Long Branch, some of the difficulties would be met.

If we assume that the old pre-Bridgeton lowland, in the vicinity of Hightstown and Amboy, was below the present 150-foot level, the Bridgeton base was below the top of the Pensauken, and all hope of separating the two formations, on topographic grounds, is gone.

The difficulty, therefore, appears as follows: The material between Amboy and Trenton regarded as Pensauken has a maximum altitude (surface) of nearly 190 feet at Amboy and a minimum altitude (base) of 60 feet in the vicinity of Amboy and Sayreville. It has a maximum (surface) altitude of 130 or 120 feet in the vicinity of Trenton and a minimum (base) of 10 or 20 feet. The material, however, appears to be a unit throughout this entire area, and throughout this vertical range. If the gravels at elevations of 150 feet at Hightstown and those still higher at Amboy are Bridgeton, we have no means of demonstrating that all the gravels down to the 20-foot level at Trenton are not Bridgeton. This assumption would lead us into still greater difficulties south of Trenton.

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On the whole, the evidence seems to suggest that the region in the vicinity of Hightstown must have been at or below what is now the 150-foot level in Bridgeton time, and that a plain at some such level at Hightstown corresponded to the 200-foot plain at Carrs Tavern, and the 150-foot plain at Lakewood.

HOMINY HILLS—MANASQUAN.

Location of section.—Fig. 35 is a section from Bonhamton north of the Raritan, to Manasquan, through Beacon Hill, Hominy Hills, and Allenwood, slightly generalized and simplified. It represents the general cross section of a belt a few miles wide, rather than a section along a line. The most conspicuous feature in the profile, as compared with preceding figures, is its relief. The hills appear high and steep-sided, and the valleys deep and narrow. Comparing this section with Fig. 33, it will be seen that there has been greater erosion in post-Beacon Hill time in this region than in the vicinity of Woodmansie.

Beacon Hill deposits.—The highest elevation is Beacon Hill, with an altitude of 372 feet. It has a cap of gravel about 10 feet thick. Throckmorton Hill, in the Hominy Hills group, about 9 miles southeast of Beacon Hill, has a similar cap of gravel. Projecting a plane from the base of the gravel in Beacon Hill through the corresponding position in Throckmorton Hill, it will be found to pass over Manasquan at an elevation of 150 feet. If this be regarded as the base of the Beacon Hill formation, it indicates that the region about Manasquan has suffered notable degradation in post-Beacon Hill time. Extending the same plane northwest over the Amboy region, it has there an altitude of 400 feet. This would indicate a degradation of 200 to 300 feet in this region in post-Beacon Hill time, if the Beacon Hill formation once overspread this region, with its normal dip.

Pre-Bridgeton surface.—From the profile, it is seen that at Hillsdale there are areas of bare Cretaceous at an elevation of about 250 feet, and others at Barrentown at about 200 feet. Near Allenwood there are gravel-capped hills at 120 to 140 feet, and this gravel appears to be Bridgeton although there may be

some question as to this correlation. It is 8 to 9 feet thick, about 80 per cent. quartz and 20 per cent. chert. It is very like that of the Beacon Hill formation except for occasional bits of iron-stone. Taylors Hill, near Hominy Hills, has a gravel cap at 180 feet, and this too, is regarded tentatively as Bridgeton. Other hills in the vicinity, at 130 to 140 feet, in the same relations as Taylors Hill, have caps of gravel interpreted as Pensauken.

These various levels are more or less discordant. Though levels at about 250 feet near Hillsdale and at 200 feet at Barrentown appear to be connected with the outcrops of certain beds of the Cretaceous, there are, in the same vicinity, other hills at about 200 feet of which the top is Miocene. It seems probable that the hills at about 200 feet near Barrentown go with the 140-foot levels at Allenwood.

Constitution of the Bridgeton.—The Bridgeton gravels of this region contain no material which can be identified as having come from the Cretaceous. The surface during the Bridgeton epoch was mostly in the Miocene and Cohansey formations, and they yielded the sand and gravel deposited here in the Bridgeton epoch. Cretaceous beds must have been exposed about Crawfords Corners, but there was little sedimentation there, or if there was, but little of it now remains.

In Pensauken time, on the other hand, the Cretaceous beds were extensively exposed, and the deposits of that epoch north of the Hominy Hills contain much material from that system. Some of the streams which flowed from the Cretaceous to the Miocene, carried sediments from the former out onto the latter.

The result was that the sediments which accumulated in the Bridgeton and Pensauken epochs in this region were quite different in composition. For instance, the gravels (Pensauken) which are found in Swimming River valley in the vicinity of Holmdel, at 140 to 170 feet, contain much material derived from the Cretaceous, and are regarded as Pensauken.

VICINITY OF BEACON HILL AND NORTHWEST.

In the region about Beacon Hill, there is very little gravel and sand which can be correlated with the Bridgeton. Eastward, near Chapel Hill, and in the Navesink Highlands, there is gravel at 200 to 220 feet which may be so correlated, but most of this material appears to have suffered but little re-working from some older formation, probably the Beacon Hill.

Northwest of Beacon Hill, the section, Fig. 35, is continued to Bonhamtown, but shows no certain Bridgeton. At Morristown, near Matawan, a small hill at 150 feet is shown with a cap of gravel. There is also gravel in a bench a few feet below the top of this hill (at 120 to 140 feet). The gravel at the lower level at Morristown is similar to the Pensauken material between Matawan and Freehold. That on the top of the hill is sufficiently different to suggest, but not to prove, their distinctness. Whether the gravel at the top and that on the bench belong together, or whether they represent Bridgeton and Pensauken, is uncertain.

The Browntown hills southwest of Matawan, with their gravel caps at about 200 feet, stand in much the same relation to Beacon Hill, as Disbrows Hill does to the hills at Clarkstown. The gravel caps of the Browntown hills, rather than the 150-foot hill at Morristown, may represent the true Bridgeton level for this region.

In the vicinity of South Amboy and Sayreville, there are considerable areas of gravel, the base of which is irregular. The lowest level of its base at Bonhamtown is about 60 feet, and the maximum altitude of its surface, near South Amboy, is nearly 190 feet. It is referred to the Pensauken, and will be described more at length later.

CHAPTER III.

THE PENSAUKEN FORMATION.

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General Description.

SEQUENCE OF EVENTS.

Pre-Pensauken erosion.—After the deposition of the Bridgeton formation, conditions in the southern part of the State changed so that erosion succeeded deposition. The southwestern part of the State at least seems to have been somewhat higher than during the Bridgeton epoch, possibly a little higher than now during at least a part of the interval of erosion.

Some of the drainage lines, during this epoch of erosion, did not differ greatly in position from those of the present time, while others were notably different. One main line of drainage seems to have been from Raritan Bay to Trenton, and thence down the Delaware. This indeed seems to have been the course of the master stream of this part of the Coastal Plain. Streams from the north joined this master stream at various points between Raritan Bay and the present Delaware, and other streams doubtless joined it from the southeast and east.

The postBridgeton-prePensauken interval of erosion was a long one,—long enough for the development of a broad plain of erosion between Raritan Bay on the northeast and Salem on the southwest. This plain was about 20 miles wide at New Brunswick, and wider still to the northeast; 12 miles wide at Monmouth Junction, 15 to 20 miles wide from Trenton to Philadelphia, 10 miles at Chester, and 20 at Salem. Cretaceous formations underlie the larger part of this plain of erosion. The main divide of southern New Jersey lay but a few miles to the southeast of this broad valley, along the line connecting the Atlantic Highlands, Mount Pleasant, Clarksburg, and Berlin.

During the period of erosion which developed the great valley noted above, streams flowing southeast from the main divide of the southern part of the State developed broad valleys which are to be correlated with the Raritan Bay-Trenton-Salem plain; but the plains of these minor valleys were much less extensive and less well defined, and have been less carefully studied, and the

deposits made in them during the Pensauken epoch have not been clearly differentiated in most parts of the southeastern slope.

Pensauken deposition.—After the development of these broad valley-plains of erosion, conditions became such as to cause deposition upon them, and these deposits constitute the *Pensauken formation*. The principal part of the formation, and the part which is most distinctive, was deposited on the valley lowland between Raritan Bay and Salem. Contemporaneous deposits elsewhere were less extensive, less distinctive, and difficult of differentiation.

The conditions and the agents of deposition have been much discussed, and there is still difference of opinion concerning them. The chief opposing views are (1) that the plains of erosion referred to above were submerged, and that the deposition which followed was marine; (2) that the plains were not submerged, and that the deposits were fluvial; and (3) that submergence was partial, and that the deposits are partly marine and partly fluvial.

According to the interpretation of the formation which assigns to it a fluvial origin, its material was brought to the Raritan Bay-Trenton-Salem plain by drainage from the north. The principal contributing streams were the Hudson, the Raritan and the Delaware, or their predecessors. This view carries with it the hypothesis that Raritan River then flowed southward from the mouth of the present Millstone, up the valley of that stream, to the master stream in the Raritan Bay-Trenton valley.

On the hypothesis that the Pensauken deposits are terrestrial, they are thought to have been made at a time when the streams from the north bore the gravel, sand, etc., of the melting ice of one of the early glacial epochs. This view is based on the physical and lithological characteristics of the deposits. If this interpretation of the origin of the formation is correct, that part of it in the Raritan Bay-Bordentown-Salem valley is a sort of broad *valley train*. One of the difficulties of this interpretation is that the materials do not decrease regularly in coarseness down the valley as in a normal valley train.

As the main valley was aggraded, its tributaries were obstructed, and deposition in them must have accompanied deposition in the main valley. None of the streams tributary to the main valley from the south and east between Raritan Bay and Salem bore glacial waters, and hence the deposits they made in their valleys were of local debris, derived from their own drainage basins. The same was true of some of the small streams coming to the main valley from the north. At the same time, deposits were probably making in the valleys of streams flowing from the main divide of the Coastal Plain southeast to the Atlantic. The lower ends of these valleys were not being aggraded by deposits in just the same way that the lower ends of tributaries to the Raritan Bay-Trenton-Salem valley were, if the hypothesis outlined above be the true one. Furthermore, the streams flowing southeastward from the Coastal Plain divide were not laden with glacial debris, as were the main streams north of the main valley. The presumption is, therefore, that if the attitude of the land remained much as it was during the time of erosion just preceding, deposition in the valleys of the southeastward flowing streams was much less than that in valleys of streams carrying glacial debris.

If, on the other hand, the Pensauken formation is marine, its sediments being laid down during a time of submergence, the deposits in the valleys which led to the sea directly may have been more considerable. Even in this case, however, deposition of sediments brought in by streams not fed by glacial waters was probably less than that contributed by streams which came out from the melting ice.

The third view of the origin of the formation is hardly more than a combination of the other two. In this case, the proportion of the formation which is fluvial might be conceived to be very large or very small, or to be anywhere between these extremes.

After the deposits of Pensauken sands and gravels in the Raritan Bay-Trenton-Salem valley had reached a thickness which exceeded two score feet in but few places, deposition ceased. This may have been because the area became somewhat higher,

giving the streams a greater gradient, or because the streams carried less detritus, owing to a change in climatic or other conditions within their basins.

Erosion of the formation.—When deposition ceased, the present systems of drainage established themselves on the new deposits. Subsequent erosion has destroyed the flatness of the depositional surface by developing valleys of varying sizes below it. In places considerable undissected areas of the formation remain, and in such places the surface is nearly flat, as in the vicinity of Prospect Plains, northeast and west of Hightstown, north of Hartford, and northeast of Moorestown. These areas probably represent, approximately, the original surface of the formation. But in many places erosion has gone so far that the surface has been much dissected, and the topography advanced to maturity, and, locally, to old age. Many of the valleys have been cut through the formation into underlying beds, and in not a few cases the valleys in these underlying beds are wide.

Even in the Raritan Bay-Trenton-Salem valley, where the formation was best developed, it is restricted largely to the divides between the streams. Generally speaking, its areas are broad where the divides are broad, as between South River and Crosswicks Creek, and narrow where the divides are narrow. The remnants of the formation are so disposed as to show that it was once continuous between the areas where it now occurs, and that its dissected condition is the result of stream erosion.

Southwest of Crosswicks Creek, the broad valley plain on which the formation was best developed is crossed by numerous tributaries to the Delaware, whose courses are roughly from southeast to northwest. These streams have not only cut through the Pensauken, but they have removed much of it, and the areas remaining stand in somewhat definite relations to the streams which flow directly to the Delaware, being elongate on the divides between them. But in many cases another factor influences their position. Many of the remnants of the formation here have a pronounced northeast-southwest linear arrangement, in disregard of the courses of the streams. This arrangement is determined by the underlying formations, which have influenced,

and locally controlled, the drainage. This has gone so far that the divides, and with them some of the elongate areas of the Pensauken, correspond, in many cases, with the outcrops of the certain Cretaceous formations, and the outcrops are at right angles to the courses of the principal tributary streams.

In other places, as about Mount Holly, the Pensauken has been wholly removed from large areas. The underlying Cretaceous beds here were easily eroded, and the Pensauken formation has been more completely carried away from the upper parts of the basins of the streams than from the lower parts, where the underlying Cretaceous was less easily eroded, and where the valleys were therefore less readily widened.

Since the beginning of the interval of erosion which followed the deposition of the Pensauken formation, erosion has been the chief process affecting the topography of the region where this formation occurs. The only other change of importance has been the partial filling of some of the valleys, leaving them somewhat less deep than formerly.

STRATIGRAPHIC RELATIONS.

The base of the Pensauken.—As a rule, the elevation of the base of any given area of the Pensauken formation is nearly the same on all sides, especially if the area is small. Furthermore, the elevation of the bases of various areas which are near one another is, in most cases, nearly the same. This is the basis for the conclusion that the surface on which the Pensauken was deposited was essentially flat, though like all plains of subaërial erosion, it was not without some relief. To this general rule of planeness there were some distinct exceptions, as will be seen.

While the plain on which the Pensauken was deposited was being developed, Delaware River had a course similar to that which it now follows, and a large part of the valley plain below Trenton was developed by its tributaries. As a result, the plain declined slightly towards the Delaware, that is from the east-southeast to the west-northwest. Between Trenton and Raritan Bay, a large part of the corresponding plain was probably de-

veloped by tributary streams which flowed northwestward to the trunk stream which then flowed through the Raritan Bay-Trenton valley. This part of the plain of erosion, therefore, sloped gently from the southeast to the northwest toward the axis of the main valley. At the southeast the broad plain of degradation was limited by a low scarp, the slope of which was much greater than the slope of the plain to the main stream.

Aside from these low slopes which the plain possessed as a result of its mode of development, its surface departed from flatness in two ways: (1) There were some minor elevations above the general level, unreduced by erosion; and (2) there were valleys excavated below the level of the plain. The elevations were, in but few cases, more than 20 to 40 feet high; but there were occasional more considerable hills, such as Mount Holly, Mount Laurel, Arneys Mount, Disbrows Hill, and the Brown-town hills, the highest of which were more than 100 feet above the plain on which they stood, before the deposition of the Pensauken formation. The low mounds on the peneplain were, in many places, buried by the Pensauken gravels and sands, but the higher hills were not buried. Such hills as rose 40 feet or more above the higher parts of the plain remained as hills after the deposition of the Pensauken formation. Good examples of low hills which were buried are found between Woodbury and Crosswicks, along the outcrop of one of the more resistant beds of the Cretaceous system. Their crests are now at an elevation of about 100 feet, and the Pensauken which once overlay them was thin.

The existence of valleys below the level of the Pensauken plain is revealed by later erosion, which shows the base of the Pensauken descending locally 40 or even 60 feet below its usual level. The complete cross-sections of the valleys below the Pensauken are not seen; but from the positions and relations of the low remnants of the formation, it is inferred that the valleys in the plain were narrow. Conspicuous examples are found at Fish House on the Delaware, at Rancocas, and at Kingston, just south of the Rocky Hill gorge.

The present elevation of the pre-Pensauken plain of erosion, that is the plain on which the Pensauken was deposited, is greatest at the northeast and decreases to the southwest. Along the axis of the valley, the base of the formation has an elevation of about 100 feet between South Amboy and Philadelphia, about 60 feet in the vicinity of Swedesboro, and 30 to 40 feet in the vicinity of Salem. East and south of the axis of the valley, the pre-Pensauken plain is somewhat higher. In the lower Delaware region, there seems to have been a rude but broad terrace east of the main valley plain, 30 to 50 feet above it. The Pensauken aggraded the lower plain to the level of this terrace, and spread out upon it in places at least. Locally, the base of the formation is considerably lower than would be indicated by the figures given above. In these places it appears to have filled narrow gorges below the level of the broad valley.

The altitude of the Pensauken surface.—The surfaces of remnants of the Pensauken formation are not, in all cases, to be taken as representing its original surface. In the vicinity of Salem and Alloway, the surfaces of Pensauken remnants have an altitude of 65 to 90 feet; about Auburn, 80 to 90 feet; at Swedesboro, 80 to 100 feet; at Haddonfield and Philadelphia, about 120 feet; at Rancocas, 90 feet; at Deacons Station, 110 feet; at Bordentown, 120 feet; at Trenton and Kingston, 120 to 130 feet; at Griggstown, 150 feet; at Allentown, 150 feet; southeast of Hightstown, at Englishtown, Hazlet, and South Amboy, 170 to 180 feet; and at Metuchen, about 130 feet. These heights vary much, but only the surfaces of the larger areas can be presumed to represent approximately the original surface of deposition. At the time of its deposition, the surface of the formation probably was lower than now.

If the elevations of the larger remnants mentioned above be taken as representing remnants of the original surface of deposition, and if the eroded beds of the formation were restored, the Pensauken surface would decline gradually to the southwest from an area about Hightstown and Englishtown, and from the same locality there would be a very slight decline to the northeast. Aside from these gentle slopes, minor slopes in various

directions can be made out. Thus there is a slope of 40 feet from South Amboy to Metuchen, of nearly as much from Englishtown to Griggstown, of 50 feet from Perrineville to Kingston, of 30 feet from Allentown to Trenton, and of 10 feet from Philadelphia to Haddonfield. These localities, taken two by two, are approximately at right angles to the axis of the valley. If these slopes could be assumed to represent the original surface of deposition, they would suggest either (1) that the main deposits were made from the southeast above Philadelphia, and from the west below that city, an inference not borne out by the constitution of the formation; or (2) that the original surface of the formation has been warped a little since its development, being tilted a little to the northwest at the north, and to the southeast at the south. Along the northwest margin of the plain at Metuchen, Trenton, and Philadelphia, the upper surface of the Pensauken has a nearly constant level. If the formation has been warped, therefore, it would seem that its northwest margin has remained more nearly fixed, or has moved as a unit, while the main body of the formation of the southeast has suffered more deformation.

At Raven Rock, 20 miles above Trenton, a bench at 200 feet, 140 above the river, is covered by what is probably Pensauken gravel, though good exposures have not been seen. The materials of the gravel are largely clastic (sandstone, quartzite, etc.), but bits of crystalline material occur. The gravel occurs down to Wilburtha, at progressively lower levels, but in meager remnants only. There is, however, enough to show its former presence.

The underlying formations.—The Pensauken sands and gravels rest on various formations of older rock. In the vicinity of Trenton, and thence to Princeton Junction, it rests on schists in some places, and about Philadelphia, it rests on similar beds over considerable areas. Here the upper formation thickens as the surface of the schist declines eastward. In most places the surface of the schist below the Pensauken is disintegrated to depths of 6 to 10 feet. Locally the disintegrated schist is so like the material of the Pensauken as to make their differentiation

difficult when exposures are poor, and it seems probable that much of the material of the younger formation was derived from the older.

Northeast of Trenton the northern part of the larger areas of the Pensauken formation lap up on shales of the Newark series. The relations are shown by Figs. 33-35. Far north of the Raritan Bay-Trenton valley there are remnants of the Pensauken formation on the Newark beds, but they are scattered and small. At Kingston the Pensauken occurs in a valley cut in the shale before the Pensauken epoch.

The larger part of the Pensauken lies on Cretaceous formations. It has been more completely removed from the Raritan than from the younger members of the system, apparently because the Raritan was more easily eroded than the others. Southwest of Trenton, remnants of the Pensauken overlie the Raritan between Rancocas and Coopers creeks; but elsewhere the outcrops of the Raritan formations have lost the Pensauken beds which overlay them. To the northeast, South River has removed the Pensauken from a large area, and this stream appears to have adjusted its course to the Raritan formation after it had cut through the Pensauken. Between Jamesburg and Trenton, more of the Pensauken remains on the Raritan formation. This is because the Millstone, which drains much of this region, crosses the Rock Hill ridge, the hard rock of which prevents the river from lowering its basin south of the ridge, as rapidly as South River lowered its basin.

The Merchantville to Wenonah formations, which constitute the Matawan group and overlie the Raritan-Magothy beds, were less completely planed down before the deposition of the Pensauken formation, and much less of that formation was deposited over their outcrops. Parts, indeed, were too high to be covered by the younger formation.

The outcrops of the Cretaceous beds above the Matawan group were still less generally covered by the Pensauken, because they were somewhat higher than the outcrops of the underlying formations; but in the basin of the Rancocas Creek, the surface of these beds was lower than elsewhere, and was more gen-

erally covered by the Pensauken. The character of the formation deposited upon the marls was somewhat different from that deposited upon the lower formations, nearer the axis of the valley.

In the southern part of the State, in the vicinity of Alloway, an area covered by the Kirkwood had been so reduced by erosion that it received the deposits of the Pensauken formation; but elsewhere the northwest edge of the Miocene was above the level of Pensauken aggradation.

Except on the southeastern slope of the Coastal Plain, the Pensauken does not lie on formations younger than the Kirkwood. The relations of the Pensauken on this slope will be considered later.

Relations to the youngest glacial drift.—At many places between Metuchen on the west and Perth Amboy on the east, the drift of the last glacial epoch overlies the Pensauken formation. The relations of the two show that the Pensauken was present in remnants only when this drift was deposited. Valley trains of gravel and sand borne out by rivers from the last ice sheet were deposited in the Delaware Valley after much of the Pensauken had been removed. Gravels of late glacial age (the Trenton gravels) overlie the Pensauken at Trenton. This relation has been seen repeatedly in temporary excavations, especially along the Pennsylvania Railroad near Clinton Street station, and at some points farther down the valley. Late glacial gravels occur also in the valleys of Bound Brook and the Millstone. The glacial gravel is distinct from the Pensauken in constitution; but where the rivers which carried the former flowed over the latter, the two types of gravel were more or less mingled in the deposits of the later epoch.

The two formations are distinct topographically in most places, but in the valley of the lower Delaware, the base of the Pensauken declines to the level of the sediments brought down the river in the last glacial epoch. Where this is the case, the two formations are not distinct topographically, especially where only the basal part of the Pensauken remains.

Relations to the early glacial drift.—In the vicinity of Metuchen, and between that place and New Brunswick on the one hand and Raritan on the other, there are occasional patches of Pensauken which are somewhat till-like in appearance, and in at least one place near Metuchen, glaciated boulders have been found in it. The relations, however, do not preclude the hypothesis that the Pensauken proper antedated the surface parts which locally contain glaciated stones. In other words, it is not demonstrated that the glaciated materials associated with the Pensauken, are really parts of it. If the glaciated boulders here are really in the Pensauken, they indicate that ice pushed down to the lower Raritan before the close of the Pensauken epoch. In some places, as at Raritan, material which has somewhat the appearance of old glacial drift overlies typical Pensauken gravel and sand. From Raritan it is but a few miles north to the border of well-defined glacial drift of an early glacial age.¹ In this region, it is not clear that the Pensauken and the old drift are closely associated in time. From all that can now be seen, the former might be older than the older glacial drift of the region. Other considerations, however, to be adduced later, suggest their close connection in time.

CONSTITUTION.

Physical characteristics.—The Pensauken formation is composed chiefly of coarse sand, with a subordinate amount of gravel, and a slight admixture of material of a clayey nature. Exceptionally, as at Fish House, the formation contains clay in considerable beds, and boulders, even up to 4 to 6 feet in diameter, occur at its base in some places. The formation nowhere consists entirely of boulders, of cobbles, of gravel, or of sand. Almost everywhere it is made up of a mixture of these materials, especially sand and gravel, in varying proportions. In some places it consists of sand with occasional pebbles, in others of compact gravel with interstitial sand only. The gravelly parts vary from fine gravel with an occasional cobble,

¹ Glacial Geology, Vol. V, p. 753.

Fig. 36.

Pensauken formation, Cole's pit, Colestown, Camden County. The material is largely of local origin, most of the pebbles being derived from the south-east. There is, however, a little Triassic shale and crystalline material.

1

Fig. 37.

Pensauken formation, Hylton's pit, Palmyra, Burlington County. Only the upper part of the formation is shown.

Fig. 38.

Pensauken formation, Hylton's pit, Palmyra, Burlington County. The basal portion of the formation shows two cobble beds, more or less cemented, separated by a foot and a half of arkose sand.

to cobble beds with fine gravel and sand in the interstices, as at Kingston.

The gravel includes quartz, quartzite, sandstone, chert, shale, crystalline rock such as granite, gneiss, schist, gabbro, diabase, etc., and ironstone. No piece of limestone has even been seen in it. Among the pebbles and boulders, the amount of crystalline material present ranges from 0 to 10 per cent., shale from 0 to 80, sandstone from 0 to 20, chert from 2 to 30, ironstone from 0 to 70. The gravel may be scattered promiscuously through the sand (Fig. 31), or it may be in beds or lenses (Fig. 36). It is, on the whole, more abundant at the bottom, and in the upper part of the formation, than at intermediate horizons (Figs. 37 and 38), but bodies of gravel in the middle portion are by no means unknown (Fig. 39).

The sand is quartzose, arkose, and in many places glauconitic. Glauconite may be in any proportion up to 90 per cent., though more than 10 per cent. is rare. Loam and clay are, as a rule, present in small quantity only.

Where arkose, the material is usually compact and coherent, and is extensively used for road material. The abundance of soft chert, shale, decayed bits of igneous and metamorphic rock, together with decayed feldspar and loam, cause it to pack well in road beds. In not a few places the material of the formation is partially cemented (Fig. 40). Locally, faulting on a small scale is shown, the gravel and sand being compact enough to behave like solid rock during movement (Fig. 41, p. 104).

Sources of material.—Among the stony materials of the Pensauken the following can be identified:

- 1) *Schist* like that which occurs at Trenton and Philadelphia, is common in the Pensauken below Trenton, but cannot, as a rule, be referred to any particular part of the schist area.

- 2) *Black shale*, with abundant impressions of plants, like that quarried at Milford, 30 miles above Trenton. Pieces of rock of this sort have been seen most frequently in the Pensauken formation between Burlington and Mount Holly, and about Deacons Station. The shale is certainly from the Newark series, though it may have come from some point other than

Milford. Deacons Station is about in line with Neshaning Creek (Pa.), which crosses Triassic beds.

3) *Stockton sandstone* like that quarried at Stockton, is found at many points. Since this sandstone is somewhat widespread, the material in the Pensauken need not have come from the immediate banks of the Delaware. Conglomerate from the Stockton formation is found with the sandstone.

4) *Red shale and sandstone* from the Brunswick division of the Newark series, and perhaps from other formations. It is not certain that all the red sandstone is from the Newark series. In the Bridgeton formation, a piece of red rock was found, very like the Newark sandstone petrographically, which contained a Pennsylvanian (late Carboniferous) fossil.

5) Pieces of *igneous rock* from the Newark series.

6) At the northeast, pieces of *conglomerate* which are probably from the Green Pond Mountain formation.

7) *Granite pebbles* and bits of *gabbro*, the sources of which are not known.

8) *Ironstone fragments*, derived from the Coastal Plain formations (Cretaceous and younger) older than the Pensauken.

9) *Quartz pebbles*, some of which show a peculiar columnar structure as they weather. Vein quartz from which they might have been made is found in the Martinsburg (Hudson River) formation of the northwestern part of the State. As constituents of the Pensauken formation, these quartz pebbles probably came from older formations of the Coastal Plain.

10) *Chert pebbles*, derived, like the last, from the Tertiary and early Quarternary formations of southern New Jersey.

11) *Glaucconitic sand* from the Cretaceous is prominent, as already noted, along the southeastern border of the main Pensauken belt.

Subdivisions.—Between South Amboy and Woodbury a three-fold subdivision of the Pensauken is recognizable in some places, but not in all. (1) The basal member is a thin bed of gravel, in many places coarse, generally carrying some crystalline rock material and some shale. Boulders are not altogether wanting—are, indeed, much more common than in any other part of the

Fig. 40.

Pensauken formation at Westville, Gloucester County, cemented by iron oxide. Excellent road material.

formation. This member is rarely more than a foot or two thick. (2) The middle member is predominantly of sand. More commonly than otherwise, the sand is arkose and well stratified. It contains little gravel, though pebbles occur singly and in thin beds which appear as bands in sections. Boulders and cobbles are virtually absent. In thickness, it varies greatly. Where the formation is thickest, this member makes up the larger part of the whole. (3) The uppermost member is gravelly, the gravel being rather fine, with some admixture of loam, and without distinct stratification. This member is thin, in most cases less than 10 feet, and in many places not more than 4 or 5 feet.

This three-fold subdivision can be looked upon as having a general application only. At many points it is not apparent. In many places material corresponding in physical constitution to but two of the three members is present, and the one which appears to be wanting may be any one of the three. Nevertheless the following generalizations seem to be warranted: (1) that during the earlier part of the Pensauken deposition more coarse material was contributed to the deposit than at any other time, and that of this coarse material a larger percentage was of crystalline rock or shale, than at any later stage of the epoch; (2) that during the middle and probably the greater portion of the epoch, sand, mostly arkose, was the chief constituent of the deposit; and (3) that during the later portion of the epoch, gravel was again more abundant, but gravel in which crystalline rock and shale were almost wanting. The region from Raritan to Raritan Bay was an exception to the last statement above, for here the last phase of the Pensauken appears to have been near the edge of an ice sheet, and in it shale and crystalline material are abundant.

The middle member is the only one which shows distinct stratification persistently. Its individual beds are in places thin and horizontal, but sharp cross-bedding is almost equally common. Where gravel is associated with the sand, the pebbles are in many cases in thin beds, making lines of pebbles as seen in section.

Geographic variations.—The Pensauken formation has its best and most distinctive development in the Raritan Bay-Trenton-Salem depression, a belt 10 to 20 miles wide and about 90 miles long. Throughout this valley, wherever sufficient remnants of the formation are present to afford a basis for generalization, it is found that the constitution of the formation changes from its northwest border toward the southeast. This change affects both the size and the kinds of the constituents. The sorts of material which are coarse along the northwestern margin, become finer to the southeast, and the decrease in coarseness from the northwest may be said to continue to the line A-B of Fig. 42. Considerable boulders (2 to 4 feet in diameter) are not rare, and in places they are common near the northwest border of the belt. All of them are from formations which outcrop to the north. But as the line A-B is approached from the northwest, large boulders become rare, and reach a foot in diameter in exceptional cases only.

A change in the lithologic character of the material accompanies the change in size noted above. While pieces of granitic and other igneous rocks are common along the northwest border of the formation, they decrease toward the line A-B, Fig. 42. Shale and sandstone derived from the Newark series have the same distribution; and so have pieces of sandstone and quartzite from the Paleozoic formations north and northwest of the Newark series.

Southeast of the line A-B, boulders of northwesterly origin are essentially absent almost everywhere; but boulders derived from formations of southern New Jersey are present. Fragments of ironstone (sand cemented by iron oxide) derived from the Cretaceous and younger formations are rare along the northwest border of the belt, but abundant to the southeast (especially southeast of the line A-B, Fig. 42), where, locally, they constitute as much as 70 per cent. of the gravel. Pebbles of quartz, too, are less preponderant to the northwest than to the southeast. These pebbles in this formation were derived in large numbers from the Bridgeton and other beds which lay to the southeast. They and the ironstone make up most of the stony

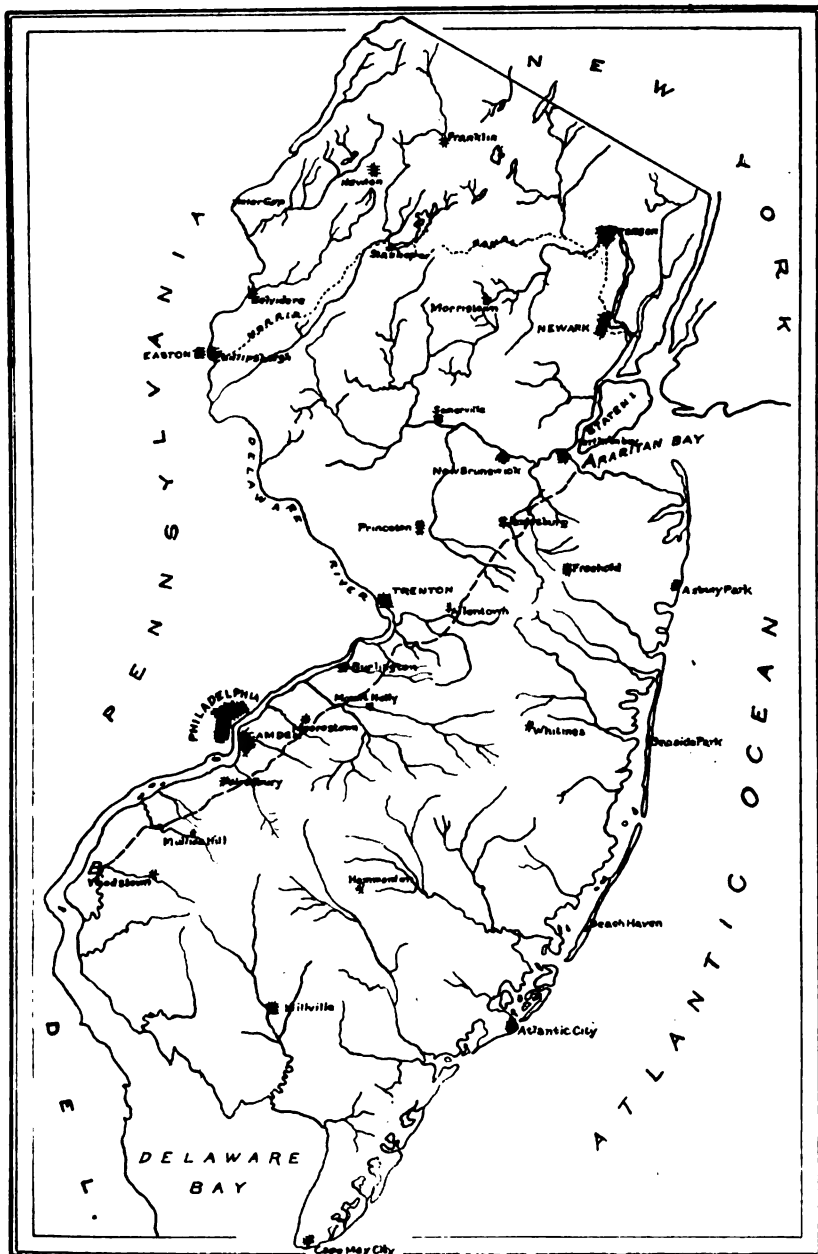


Fig. 42.

Outline map of New Jersey showing line of demarcation (A—B) between the arkose Pensauken on the northwest and the locally derived Pensauken on the southeast.

material southeast of the line A-B, Fig. 42, though some chert is present in most places.

Among the finer sandy constituents of the formation, glauconite is absent or rare at most places along the northwest border of the formation. Along the center of the belt it is present in small quantity in many places, and southeast of the line A-B there are considerable beds of Pensauken sand in which glauconite grains make up 10 per cent. or more of the whole.

The changes in the constitution of the formation from northwest to southeast outlined above are less distinct below Woodbury than farther north. This is perhaps because the remnants of the formation remaining at the south are less extensive than those to the north, and form a less adequate basis for comparison.

These changes in the coarseness and in the petrographic constitution of the formation are intelligible if the formation was deposited primarily by land waters flowing to the main valley, from the northwest on the one side, and from the southeast on the other. The waters from the former direction brought in materials from the north and west, the coarse being deposited first. The drainage from the southeast, flowing over different formations, brought in different materials, and their coarser parts were left first, near the southeast margin of the broad area of aggradation. Toward the center of the belt the materials from opposite directions are much mingled.

It seems probable that a similar distribution of materials would exist if the broad valley under consideration were submerged during the deposition of the Pensauken formations. If it were converted into a sound, rivers would have contributed sediment to its borders from either side, and the waves of either shore would have acquired materials from the formations found there, the coarser being carried out lesser distances from the shores. Even in this case much of the material must have been contributed by rivers, for the shores of the sound would nowhere have touched granitic rocks, or Paleozoic sandstone and quartzite. They would have touched the red shale and trap rock of the Newark series; but it is not clear how materials from

these formations could have been carried across the sound to the opposite side, if waves and currents only were the agents of transportation.

The line A-B of Fig. 42, referred to repeatedly in the preceding paragraphs, is not to be understood to be an absolute line which materials from opposite directions did not cross. It is rather the line along which materials of northwesterly origin, abundant at the northwestern margin of the belt, become so unimportant quantitatively as to be negligible. If a line were to be drawn representing the northwestern limit of southeastern material plentiful enough to be recognized readily, it would be essentially parallel to A-B, but a little northwest of it.

Differences in sand go with differences in the coarser materials. Thus where the glauconite is wanting, the sand is, as a rule, more or less arkose. Along the southeastern part of the belt (southeast of A-B, Fig. 42), where glauconite is common, the sand is rarely arkose. Northeast of Crosswicks Creek, there is a rise of 20-40 feet in the base of the Pensauken, going southeast, about where its arkose character disappears.

Local variations in constitution.—There are some areas where boulders are much more abundant than in others, irrespective of distance from the northwest border of the formation. Thus in the area southeast of Trenton (near Bordentown), boulders are relatively abundant, and of larger size than in most other places. This area, it will be noted, is below the point where the Delaware leaves the harder formations north of the Coastal Plain, and takes its course across the Cretaceous system. The boulders here were probably brought down by the Delaware, and left where its gradient became low on the weaker formations. Another area of abundant boulders is south of New Brunswick, an area which stands in a somewhat similar relation to the Hudson.

At Kingston, just south of the Rocky Hill gorge, is the coarsest bed of gravel known in the Pensauken. The material is entirely of northern origin, and was apparently left by a stream which, at the time of deposition, flowed south to this point from the Highlands. The gravel at Kingston is but a

remnant of a deposit which was, at the outset, much more extensive.

In the vicinity of Philadelphia, the bottom of the formation runs down below its normal level in a relatively narrow pre-Pensauken valley in the bottom of the broad Delaware Valley. When deposition began, this narrow valley was filled with such material as the drainage then afforded. Later, after its bottom had been filled, deposition took place at higher levels.

The deposits of the lower level, especially below 40 feet, are somewhat unlike those of higher levels, especially above 70 feet. Between these levels there is a mixture of the material characteristic of the lower and the higher horizons. The Pensauken material at the low levels is composed of quartzitic material largely, with some gneiss, schist, and shale, but with little granitic gravel. Its elements are not well rounded, and have been worn but little. The gravel appears to have been brought to its present position by the Schuylkill, and becomes finer with increasing distance from the debouchure of that stream. Above the 70-foot level, the Pensauken is commonly arkose, as generally in the area where it is normally developed. This arkose material was probably contributed in part by the Delaware after that river began to bring its load of gravel and sand down to this latitude; but much of it came from the schists of the Trenton-Philadelphia region. Pensauken gravel and sand likewise fill some rather deep side valleys in this latitude, one near the present course of Crosswicks Creek, and others farther south. In the side valleys, the difference between the material of the upper and lower levels is not so pronounced.

Bearing of constitution on origin.—The persistence of the arkose sand and its uniformity over great areas, has a bearing on the origin of the Pensauken. At first thought, it might seem to favor the hypothesis of submergence, as a deposit in a sound might be more uniform than deposits made by a series of rivers. This argument is, however, not very convincing, since the materials for the deposit, even in a sound, would have to be contributed by rivers, to a large extent.

There are local variations in composition corresponding, in a measure, with what might be expected along shores. Thus along

the northwestern border there is much shale in the Pensauken, at least in spots. This is true, for instance, northeast of Trenton. Southeast of Trenton, where the underlying formation is schist, much material from this formation appears in the gravel. On the other hand, the correspondence between the composition of the younger formation and the character of the base on which it rests, or of the older rocks against which it abuts, is not so close as the shore hypothesis seems to demand. Shaly material is found in spots, at least, far from the outcrops of the shale, and on the opposite side of the hypothetical sound.

The arkose character of the sand is well developed from Trenton to Wilmington near the Delaware, about Hamilton Square, Newtown, Hightstown, South Amboy, Old Bridge, and Woodbridge. From both the northeast and southwest, the arkose character becomes less conspicuous towards Jamesburg, where much of the formation seems to have come from the south. This suggests that the Delaware and the Hudson were the great contributors of the arkose sands, and that at Jamesburg, about equally distant from the two sources, it is least prominent.

Theoretically the Raritan was equally well situated for bringing in arkose Pensauken gravel, but in that part of its former basin which is low enough to have received deposits, remnants of the Pensauken are small.

There is nothing in its constitution to negative the hypothesis of the whole formation being river work, nor is there anything, as now understood, to prove it. The widespread uniformity of the second number (p. 81) might be said to argue submergence. The upper member, on the other hand, is more like flood plain deposits, or subaërial wash. The basal member, also, is not unlike a river deposit, though it is difficult to understand how such coarse material could have been carried by rivers so far with so little rounding. The help of floating ice seems to afford the only escape from the difficulty.

The absence of fossils in all places where the formation is normally developed, is negative evidence. The condition of the formation in most places is such that fossils could not have been preserved, even had they been abundant at the outset. At Fish

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House, but little above sea level, fresh-water shells are found in clay which is probably to be correlated with the Pensauken. On the whole, the belief is entertained tentatively, that rivers were the agents chiefly concerned in the depositions of the formations, and that such part (if any) of it as is marine is very subordinate.

THICKNESS.

The formation was, on the whole, thickest along the axis of the Amboy-Bordentown-Salem belt, and thinned both to the northwest and southeast. The greater thickness near the axis of the belt seems to be because the bottom of the valley was lowest there, when deposition began.

It is probable that the original maximum thickness of the formation in the vicinity of Philadelphia was not less than 120 feet. This is the elevation of its surface in Philadelphia, and at Haddonfield on the east side of the river. In the vicinity of the city hall in Philadelphia excavations down virtually to sea level have been seen, showing Pensauken gravel down to that level.

In the vicinity of South Amboy, the surface of the Pensauken reaches an altitude of 170 feet. The level of its base is about 90 to 100, but in two spots in that vicinity its base is known to go down to within 20 feet of tide level. If the Pensauken material at these low levels is not the result of slumping, it indicates great maximum depth of the formation here.

The average thickness of the formation, *as it now exists*, is much less than that suggested by the figures given above. In the vicinity of Philadelphia, it is commonly not more than 10 to 20 feet outside the deep valleys. About Bordentown it has a depth of 20 to 40 feet; about Jamesburg, 40 to 60 feet; and at South Amboy, as much as 70. Its average original thickness was doubtless more than the smallest of these figures, and less than the largest.

AREAS SOUTHEAST OF THE MAIN BELT.

Southeast of the main belt of the formation, there are many areas of gravel and sand, some large and many small, which are, perhaps, to be correlated with the Pensauken formation. The areas in question are partly to the north and west of the main divide of southern New Jersey, and partly to the southeast, on the Atlantic slope. In general, these parts of the Pensauken formation, if such they are, lie on divides and hills, though not on the highest divides and hills along the crest of the watershed. Their altitude is greatest as this divide is approached, whether from the north and west, or from the south and east. Near this divide, their altitude is somewhat greater than that of the Pensauken formation in the Raritan Bay-Trenton belt. From this divide the altitude of these areas declines with the streams in both directions, so that the altitudes have a wide range, from 200 feet or so at a maximum, down to 60 feet or less at the southeast, far from the main divide of the southern part of the State. Many of the patches of gravel in this area are so arranged as to suggest that the material was deposited by streams flowing parallel to those of the present time. Some of the patches, on the other hand, show no such association with the courses of existing streams.

In essentially all cases—perhaps in all—the materials of these areas came from underlying and adjacent formations. At the northwest and west, the Cretaceous formations contributed much. This is true in most places north and west of the main divide. On the Atlantic slope, on the other hand, the streams, as a rule, had no access to Cretaceous formations, and the Tertiary and earlier Quaternary formations were the immediate sources of the material regarded as probably Pensauken. The sand is not arkose, and the gravel consists of quartz, chert, etc., from the Bridgeton and Beacon Hill formations, and of ironstone, derived from the cemented parts of the older formations of the region. Where the Cretaceous formation contributed, glauconite is present commonly. Sand definitely recognized as from the Miocene, is found in many places. So also is sand from the Cohansey

(Pliocene?) sand beds. In addition to these finer materials, there are some large boulders of quartzite from the Kirkwood (Miocene), for though most of the Kirkwood sand is not cemented, it appears to have been cemented to quartzite in a few places, and these portions have given rise to boulders. The "Lime Sand" of the Cretaceous also has given rise to boulders in some places.

This non-arkose phase of the Pensauken is thin for the most part, and its remnants scattered. It is doubtful if it ever covered the whole of the area within which it is found, and much of that which once existed has been removed. If these deposits be fluvial, they were made along the water courses of the time, and large areas were perhaps never covered by them. If this view is correct, some of the old stream courses have since become divides. Since glacial waters did not affect the streams concerned in the deposition of this phase of the formation, the deposits were much less considerable than in the main Raritan Bay-Trenton valley. Furthermore, the streams involved were all small, as compared with those which contributed to the main area of the Pensauken formation, and they did not come from areas of such great altitude.

Differentiation of the formation, especially on the southeast slope, is difficult, for deposition by streams has taken place in later time, and these later deposits (Cape May formation) rise upstream, and in many places reach levels which make them inseparable, topographically, from the deposits of the Pensauken epoch. In constitution, too, the gravels of the two ages are essentially the same. The most persistent differences are (1) the apparent greater age of the Pensauken, as contrasted with the Cape May. This is shown by more cementation, more incrusting of grains and pebbles with iron oxide, more oxidation of glauconitic grains, more decay of chert, etc.; and (2) topographic position, for much of the Pensauken occupies divides, while most of the Cape May formation is in the form of terraces, or on lowlands near the shore.

Local Details.

THE LOWER DELAWARE VALLEY.

The pre-Pensauken surface.—In pre-Pensauken time, the Delaware flowed about where it is now, and received tributaries, somewhat as now, from the east. Along the lower course of the main stream there were two bordering plains or broad terraces. The lower plain or terrace, which will be called the *Swedesboro Plain*, lay nearer the Delaware, and was limited at the southeast by an interrupted scarp extending from Cinnaminson, Merchantville, Mt. Ephraim, Woodbury, Swedesboro, Auburn, through or near Halltown, to Mannington Creek. The higher plain or terrace to the southeast, the *Woodstown Plain*, was about 50 feet higher, 3 to 5 miles wide, and was in turn limited at the southeast by another scarp. These scarps were determined by the outcrops of certain resistant beds of Cretaceous. The principal pre-Pensauken tributaries corresponded in position, in a general way, with the present Alloway, Salem, Old Mans, Raccoon, Mantua, Timber and Coopers creeks. Below the lower terrace, the streams had rather narrow, shallow valleys.

During the Pensauken epoch, deposition was heaviest on the Swedesboro Plain, and on this plain, it was greatest near the Delaware. Deposition on this plain continued until it was built up nearly or quite to the level of the Woodstown Plain. The deposits on the lower plain contain, in most places, some arkose sand and gravel which appear to be the contribution of the Delaware and the Schuylkill rivers, while the contemporaneous deposits on the Woodstown Plain were chiefly of non-arkose material brought down from the east and southeast by the streams coming to the Delaware from that direction.

The existing remnants of the Pensauken are much more extensive on the Swedesboro Plain than on the Woodstown Plain above. It was more widespread and more continuous on the lower plain at the outset, and subsequent erosion has removed

it from a larger proportion of its original area on the higher plain, for here its development was largely in valleys, and the streams of later times have carried much of it away.

It is quite possible that some remnants and patches of gravel and sand interpreted as Pensauken, especially on the Woodstown Plain, really antedate the time of principal Pensauken deposition, being remnants of gravel accumulated on the surface during the pre-Pensauken interval of erosion. Minor deposits, as is well known, may be made on a surface where degradation is the dominant process.

Deposits south of Salem Creek.—South of Alloway, on the divide north of Deep Run, and again west of Deep Run, $1\frac{1}{2}$ to 2 miles southwest of Alloway, are considerable areas of sand and gravel regarded as Pensauken. Smaller areas occur 1 and 2 miles east of Alloway, one on a low divide, and one on a hilltop. In this vicinity, there is little distinctive material in the Pensauken or in what is interpreted as Pensauken. The material is largely of loam with some sand, and a thin bed of gravel at the base. The coarser materials are of easterly origin. The remnants are so disposed as to suggest that a mantle was once widespread at an elevation of 60 feet or so in the vicinity of Alloway, and 90 feet or so 3 or 4 miles farther east. The material is classed as Pensauken chiefly on the basis of its topographic position. Its altitude and the isolation of the elevations which it caps, are harmonious with the corresponding features of the distinctive Pensauken farther north. The materials were probably deposited by tributary streams after the Delaware had begun the aggradation of its valley in the Pensauken epoch. Such a filling in the main valley would have necessitated deposition in the valleys of the tributaries.

East of Alloway the material mapped as Pensauken is mostly sand derived from the Cohansey formation, reworked and redeposited; but locally the Miocene clay of the region has contributed much to the formation.

In places, as northeast of Alloway, the materials interpreted as Pensauken are disposed in elongate patches, perhaps representing the former courses of streams. As a result of later erosion, these old stream courses, with their deposits of sand

and gravel, came to be ridges, while the more easily eroded materials on either hand was carried away. Up-stream, the old valley deposits become less and less distinctive, and merge into the valley deposits of more recent times. Here, as elsewhere, the site of deposition in the valleys moved up-stream, as the stream advanced in age. In the Pensauken epoch the streams tributary to the Delaware were shorter than now.

Two to three miles north of Alloway, near Riddleton, a section at an elevation of about 80 feet shows¹

- 3) 1-3 feet of clay loam.
 - 2) 4 " of stratified sand and clay.
 - 1) 2 " of gravelly clay.
- Miocene clay (at the base).

Similar sections are repeated many times in the vicinity. The pebbles are mostly quartz, chert, and sandstone, and their surfaces in many cases are coated with iron oxide, giving them a rusty appearance.

Another section seen about 3 miles northeast of Alloway showed

- 3) 3 feet of gravel, sand and loam, with cobbles, and even boulders 1 foot in diameter.
 - 2) 1 foot of conglomerate, cemented by iron oxide.
 - 1) 2 feet of sand.
- Miocene clay.

Similar sections occur at various points in the region between Alloway and Yorktown, at elevations of 60 to 90 feet, mostly on the low divides.

East of Welchville, in a hilltop at an elevation of 64 feet, the section of material regarded as Pensauken is as follows:

- 3) 2 feet of sandy loam.
- 2) 2 feet of sandy gravel.
- 1) 10 feet of sand, white, yellow, brown, with thin layers of black grains.

¹ In all sections following, the lowest member is at the bottom, and is numbered 1). The second member from the bottom is numbered 2), and so on.

"Bullshead" boulders are scattered over the surface at some points between Mannington and Salem creeks, and in places they have been gathered into considerable piles. They are relics of the Miocene sand which once covered the region, and which was, in spots, cemented into quartzite. Occasional boulders are 3 feet in diameter, as southeast of Halltown.

In the patches of Pensauken gravel about Big Mannington Hill, 4 miles north of Alloway, there are slabs of conglomerate, the conglomerate containing pebbles of quartz, chert and sandstone, cemented by iron oxide, and clearly derived from the Bridgeton or the Beacon Hill formation.

Between Salem and Raccoon creeks.—Between these creeks the Pensauken gravels and sands lie mostly between the levels of 50 and 80 feet at the west, but rise eastward to levels of 100 feet or so within 4 to 6 miles. The formation is in patches only, and the smaller patches are mostly on low swells near the streams, somewhat below the level of the divides.

A considerable bed of Pensauken occurs just north of Woodstown at an altitude of about 60 feet. The material consists of sand from the Kirkwood formation to the north and east, and gravel and sand from the Cohansey and Bridgeton beds to the east. The materials are so distinctive as to make identification of their sources easy. They might have been brought to their position by Salem Creek and its tributaries, or by streams following the general courses of the creeks named. A section here shows:

- 3) 2 feet of pebbly yellow loam (post-Pensauken), or a weathered product of 2.
- 2) 6 feet of compact red brown sand, gravel and loam.
- 1) 3 feet coarse sand, with grains slightly coated with clay, giving the whole a somewhat arkose appearance.

The relations of the Pensauken here to the Bridgeton are shown in Figs. 16 (p. 40) and 43 (p. 136).

Toward the creek the formation runs down to the Cape May level (to 50 feet, and possibly to 30), and where this is the case the two formations are distinguished by constitution only (Figs. 16, 43). In places the Cape May laps up over the Pensauken,

concealing its lower edge. The bottom of the pre-Pensauken valley here was as low as the present 40-foot level.

Between Woodstown and Auburn, there are a few patches of non-arkose gravel on divides and crests, doubtfully correlated with the Pensauken. The patches in question occur at altitudes ranging from 70 to 114 feet, and some of the gravels may be deposits left during the time of general degradation which followed the deposition of the Bridgeton formation, and preceded the deposition of the Pensauken.

Below Auburn, the Pensauken is somewhat arkose, a characteristic which persists to the northward and northeastward. Even the Bridgeton formation of higher levels did not furnish arkose material, shale, etc., to the Pensauken of the upper part of the valley of Old Mans Creek. If these materials were acquired by this stream in the Pensauken epoch, as seems probable, the soft shale and decayed crystalline rock were worn out during their transportation, and do not appear in the gravelly parts of the deposit. The arkose element at Auburn is the contribution of the Delaware. Auburn is about the place where the arkose, Delaware phase of the formation meets the non-arkose phase, lying farther from the main stream. The general relations of the formation in this latitude are shown in Fig. 43.

A mile and a half northwest of Auburn, there is at least 15 feet of arkose sand, with occasional pebbles of red shale. In this vicinity, too, a few bits of trap rock are found, and even an occasional boulder. Trap rock has not been seen in the Bridgeton of this general region, and it is believed to have come down the Delaware during this epoch. Here, too, the Pensauken contains granite pebbles not seen in the Bridgeton in this vicinity, though bits of gneiss occur in that formation. To the west, the base of the Pensauken descends to 30 feet, or even lower, beneath the Cape May formation.

At Auburn the non-arkose phase of the formation runs up to the altitude of 100 feet more or less. It is an open question whether the arkose phase reached the same level, being degraded later.

There are numerous patches of Pensauken on the north side of Old Mans Creek, which appear to represent former stream accumulations of gravel and sand. It is probable that the streams have since, by monoclinical shifting and otherwise, abandoned their old channels filled with gravel and sand, and that these channels, by subsequent erosion, have become low ridges. The Pensauken remnants from Harrisonville west, therefore, may perhaps mark roughly the former course of Old Mans Creek, or its antecedent. The constitution of the Pensauken changes down stream. Each formation crossed by the stream contributed material to the deposit below its outcrop, and these materials are easily distinguished. This variation in constitution is, of course, good evidence of the fluvial origin of the material.

The remnants of the formation differ in their topographic positions and relations. At Harrisonville the remnants are well down the slopes of the valley, at levels of 80 to 100 feet, and not distinctly separated from the Cape May formation. Near Auburn, they are on slopes mostly between 70 and 50 feet, and on a divide up to 100 feet; and are topographically distinct from the Cape May. Some of the patches on the north side of Old Mans Creek are continuous from elevations of 100 feet, down to 50 feet. If the lower part is not displaced, it shows a pre-Pensauken slope toward the axis of the present valley of 40 to 50 feet. At Auburn, on the south side of the creek, the relations are similar. If these beds were on slopes originally, the surface must have been built up in Pensauken time, to a level which is now 100 feet or so above sea level. As in many other places, it is not demonstrable that the Pensauken in the valley of Old Mans Creek above Auburn, is the exact equivalent of the arkose Pensauken west of Auburn; but their topographic relations seem to place their deposition at about the same time.

On the other hand, it cannot be too often reiterated that the deposition of sediment in valleys is a more or less continuous process. Even in a region like this, where epochs when deposition predominated, alternated with epochs when erosion predominated, there was some deposition in times of dominant erosion, and doubtless some erosion in times of dominant deposition. In the region, therefore, there are doubtless gravels

of various ages, some of which antedate, and some of which follow the main Pensauken deposits, and their definite separation is impracticable.

At Auburn the Pensauken gravel is cemented locally by iron oxide to conglomerate, the cemented beds being 4 or 5 feet thick. This may be seen in a gravel pit just east of the village, and again about a mile east of Auburn, on the south bank of Old Mans Creek, capping an isolated hill. Other examples of the cemented Pensauken are seen on the north side of the valley, 1 to 1½ miles northeast and east of Auburn. Farther up the valley cementation is less common. There is apparently some relation between the cementation and the nature of the base, cementation being more common where the Pensauken lies on the Cretaceous (Auburn to Harrisonville Station), than where it covers the Miocene (Harrisonville to Harrisonville Station).

Other patches of arkose Pensauken exist west of Swedesboro, at levels of 70 feet and less, declining to 40 at the west. Here the younger Cape May formation overlaps the low western edge of the arkose Pensauken, and the Pensauken descends beneath the Cape May, at Center Square. Its base therefore declines westward toward the Delaware.

Just south of Robbins Hill, the non-arkose phase of the Pensauken gravel occurs at 100 feet, and is very like the corresponding phase at Auburn at the same level. The arkose Pensauken here is distinctly lower. This relation, taken by itself, suggests a twofold division of the Pensauken, a younger, lower, arkose division, and an older, higher, non-arkose division; but evidence suggesting the unity of the two phases is at least equally good, even in this region, and is convincing (Knapp) in some others.

A characteristic section of the non-arkose Pensauken, a mile west of Harrisonville, is as follows:

- 5) 3 feet yellow loam and sand.
- 4) 8 feet gravelly yellow sand, gravelly gray sand, and clay loam. gray sand and clay in alternating thin beds.
- 3) 2 feet pale bluish white gritty clay.
- 2) 6 feet of compact gravel.
- 1) 8 feet of gray sand with about 5% of glauconite.
Cretaceous.

While an exceptionally thick section (27 feet), its composition is characteristic of the formation in the valleys of tributary streams.

Between Raccoon and Mantua creeks.—Very considerable beds of arkose Pensauken are found north and west of Swedesboro, between Rulons and Clarksboro, on the Swedesboro Plain. At the northwest, the base of the formation has an altitude of 20 to 50 feet, and at the southeast, 50 to 90 feet. In places there are 20 to 30 feet of arkose sand, with only occasional seams of pebbles, among which shale and bits of crystalline rock occur. If the very base of the formation is excepted, there is more gravel in its upper than in its lower part. The arkose phase of the Pensauken stops promptly at an elevation of about 90 feet. This appears to have been the upper limit of aggradation by the Delaware.

About Rulons and Asbury Station the formation is at least 30 feet thick in places (Fig. 44). It must have been thicker still originally, for the top probably reached an altitude of 80 or 90 feet. West of Asbury Station its base runs down to 30 feet or so. Considerable patches of the arkose phase of the formation occur about Tomlins and Mickleton, and the non-arkose phase runs up to 100 or even 108 feet a mile east of Mickleton. The former phase is well developed about Clarksboro, where it is exposed in various pits.

Northeast of Swedesboro, some non-arkose gravels of uncertain age cap elevations at 114 and 115 feet, the gravel being cemented to some extent. The slopes between these hills and the arkose Pensauken at lower levels are nearly bare Cretaceous, and represent the old pre-Pensauken scarp, at the eastern border of the Swedesboro Plain.

East of Swedesboro, the non-arkose material classed as Pensauken occurs at various heights, and may be of different ages. If the arkose phase was built up by the Delaware to the present level of 80 or 90 feet, the contemporaneous deposits of Raccoon Creek should have risen perhaps to 100 or 110 feet at Mullica Hill. Most of the gravel and sands classed as Pensauken east of Swedesboro and north of the Raccoon Creek lie between the levels of 80 and 100 feet. The 114 and 115-foot patches east of

Rulons are hardly consistent with these levels. They probably are older, perhaps accumulations of postBridgeton-prePensauken age. In constitution these deposits consist of various combinations of sand and clay with a variable amount of gravel, all from formations up stream, or at elevations above the valleys.

The question concerning the Auburn, Asbury, and Mickleton patches is the following: Is the low-lying Pensauken surface (Auburn, 60 to 70 feet; Robbins Hill, 50 to 60 feet; Asbury Station, 70 to 80 feet; Mickleton, 60 feet) a surface of deposition (on the Swedesboro Plain), or a surface of degradation developed in the Pensauken below its original top? If the latter, the Pensauken here may have been a part, genetically, of the high-level Pensauken to the east. The evidence of this region, taken by itself, would look to the distinctness of the two phases of the formation.

If the Swedesboro Plain were built up to the level of the Woodstown Plain, it would at first seem that arkose should have extended onto the upper plain; but farther northeast the facts seem to deny the necessity of this conclusion. At Jamesburg, for example, the Pensauken was very thick, and was built up to the top of the corresponding upland; but only the lower part of the Pensauken at Jamesburg is arkose, and the higher, overspreading part is not. If a plain of erosion developed at 110 feet at Jamesburg, we should have the general relations of the Swedesboro region duplicated.

South of Wenonah, in the south bank of Mantua Creek, there is the following section, interpreted as Pensauken:

- 5) 3 feet reddish-brown clay.
 - 4) 8 feet of gravel, sand and loam, interstratified.
 - 3) 4 feet grayish sand, loam, and clay interbedded.
 - 2) 3 feet gravelly and glauconitic sand and green clay.
 - 1) 1 foot of iron-cemented conglomerate.
- Cretaceous.

This section stands in a general way for the sections of the formations east of the arkose part.

Between Mantua and Coopers creeks.—The arkose Pensauken in this region appears to have been limited at the east by an old

scarp which was irregular, and much broken by the valleys which came down from the southeast. The existence of pre-Pensauken valleys coming down from the Woodstown Plain to the Swedesboro Plain is shown by the disposition of the Pensauken beds, which decline toward Timber Creek and Coopers Creek from both sides. This relation is less evident along Mantua Creek, and this valley was probably less developed. The arkose gravel went up the valleys of Coopers Creek and Timber Creek to a slight extent.

On the whole, the evidence seems to indicate that the pre-Pensauken surface had a well-developed drainage system, with valleys as steep-sided as those of today. There is one such steep slope where the Cretaceous surface falls away from 80 feet, near Bell Mawr Station, to 30 feet in the south bank of Little Timber Creek, a distance of one-fourth mile. At other places in the vicinity of Bell Mawr, the surface of the Cretaceous has equally steep slopes in such relations as to indicate that the slopes were pre-Pensauken.

Such evidence as is available indicates that the valleys of the tributaries were hardly as deep as now, while the valley of the Delaware was quite as deep. At Haddonfield, no Pensauken valley could have been lower than 40 feet, while at Wenonah, a valley may have existed down to 20 feet.

Between Mantua and Coopers creeks there are considerable areas of arkose Pensauken. The principal ones are southwest of Woodbury (west of Tatems at 50 to 70 feet), north of Woodbury (at 40 to 70 feet), at North Woodbury (at 40 to 70 feet), between Big and Little Timber creeks a mile south of Mount Ephraim (at 50 to 80 feet), and between Mt. Ephraim and Haddonfield, where it reaches up to 120 feet. In all these areas, the Pensauken rises to the east. The slope of the Swedesboro Plain was from 60 feet at the scarp in the vicinity of Woodbury, to 20 near the Delaware, and from 80 feet near Haddonfield, to 30 near the Delaware northwest of that point.

The Pensauken formation underlies the main part of Woodbury, and varies much in composition from point to point. Near Magnolia Grove, 7 feet of gravel and sand overlie 8 feet

of arkose sand. The stony matter of the upper member is coarse, up to 1 foot in diameter, and pebbles are not wanting in the lower, which is glauconitic. At other places in the vicinity much of the material is cemented by iron, or its grains and pebbles are coated with it. Near Mantua Creek, the arkose Pensauken occurs up to 76 feet near Tatems. This, with its position to the southwest, suggests the building up of the Swedesboro Plain by the Pensauken deposits to 70 or 80 feet.

To the east of these principal areas of arkose Pensauken, there are numerous areas of the non-arkose phase of the formation, the areas being poorly defined, and their correlation more or less uncertain. In general, this phase of the formation is higher than the arkose phase, and it is found neither in the valleys nor on the highest lands, but over areas of intermediate height. Not rarely it caps low divides and broad flattish areas above valley bottoms and valley terraces. In some places it occurs in elongate belts more or less parallel to the stream, as above Wenonah, above Blackwood, and above Chews Landing. The elongate patches in these positions suggest that the materials concerned are stream deposits, subsequently left as low ridges by the migration of the streams.

Proof that the arkose Pensauken to the west and the local Pensauken to the east were absolutely contemporaneous, is wanting. The two do not grade into each other, but their positions suggest their contemporaneity, especially if both are primarily the work of streams. Up the valley of Mantua Creek, just south of Wenonah, a considerable bed of gravel caps the low divide between Chestnut Creek and the main valley. The base of this gravel has an elevation of 50 to 70 feet. The top rises to 80 feet, and still higher toward Sewell. In position, these gravels are in harmony with those near Mickelton and Woodbury.

It appears that when Pensauken deposition began, the Swedesboro lowland was uneven, and that it was built up by the Pensauken arkose deposits to what is now the 80-foot level in the vicinity of Woodstown, and to 120 feet in the vicinity of Haddon-

field (Fig. 45, p. 136). This accumulation on the lower plain necessitated deposition on the upper (Woodstown) plain along the courses of the streams which crossed it.

The height of the Pensauken in the tributaries was influenced by its height in the main valley, and the tributary streams followed consequent courses over the newly deposited Pensauken of the main valley. The fact that the streams from the higher plains left them by pre-Pensauken courses shows that the Swedesboro plain was not built up to the Woodstown plain level.

Below Wenonah, patches of gravel occur up to 85-97 feet, which may be interpreted as local accumulations in Pensauken time or before. Other similar patches occur south of Mantua and west of Barnsboro. At Sewell heavy beds of gravel run down to 20 feet, showing a pre-Pensauken valley to this level, if this gravel is Pensauken, as interpreted. This is regarded as a deposit made by Chestnut Branch, which has shifted to the left since, leaving its old channel a ridge. The same thing is repeated north of Mantua Creek, and between it and Monongahela Creek. Here the divide is well over toward Monongahela Creek, with a steep slope toward that stream and a gentler, gravel-covered slope in the opposite direction. South of Hurffville, along Pethel Run, there are benches of gravel at 70 to 80 feet, but their age is not determinable. In this vicinity the distinctions between the Cape May and Pensauken formations are slight, both as to position and constitution.

Along Timber Creek, the phenomena of Mantua Creek are, in principle, duplicated. The Pensauken deposits $1\frac{1}{2}$ miles south of Chews Landing are equivalent to those at Sewell, and the gravel is locally cemented. Similar phenomena are repeated between Greenloch and Blackwood, and again on the south side of the South Branch of Timber Creek, northwest of Turnersville. As at Hurffville, the Pensauken and the Cape May formations are here hard to separate, for the two overlap in elevation. Below Greenloch, the distinction between the two is not difficult.

Besides the larger patches along the streams, small hill-top patches occur. The Pensauken gravel of these patches is very

various, but the more striking contrasts come from the fact that some parts are much more cemented than others.

The vicinity of Blackwood in post-Bridgeton time, was developed to a fairly definite plain in which valleys 20 to 60 feet deep were cut. This was the topography when the deposition of the Pensauken formation began. Much of the so-called Pensauken on this plain may have been stream deposits made as the plain developed. Such deposits were followed by the deposition resulting from the filling of the Delaware.

Between Coopers and Rancocas creeks.—Between the lower ends of these creeks, there are two belts of Pensauken remnants, the one near the Delaware and the other a few miles farther back. In the belt nearer the river, the patches occur near Fish House (Beidemans-Bethel-Merchantville), southeast of Morris, about Cinnaminson (east of Palmyra), and smaller ones at and near New Albany, Fairview, Pavonia and Delair. At the highest, the surface of the formation in these patches reaches an elevation of 100 feet, as at Merchantville, while its base ranges in altitude from about 60 feet, down nearly to sea level. At Fish House, indeed, it probably goes down to sea level, under younger beds. The general relations of the Pensauken in this latitude are shown in Figs. 45, 46 and 47 (p. 136).

The patches of the second belt occur north of Ellisburg and southwest of Moorestown, between the north and south branches of Pensauken Creek, at Moorestown, and thence north to Swedes Run, and northeast nearly to Rancocas Creek. The elevation of the surfaces of these remnants is about the same as that of the patches to the west, but their bases are not so low, rarely below 50 feet. The altitude of the Swedesboro Plain here was about 70 feet, a level which extended well up to the Delaware.

These two series of remnants are so related to each other and to drainage lines as to show that they were once continuous, and that their isolation is the result of stream erosion. The smaller streams, such as Pompeston Creek and Swedes Run, have not dissected the area to the extent the larger streams have.

The material of the formation nearer the Delaware is more gravelly, that of the remnants farther from the stream more

sandy. In the latter, most of the gravel is near the top. In the former, gravel predominates over sand, and considerable beds of arkose sand free from gravel are rare.

For the eastern patches, the material near Ellisburg is characteristic. Here, at the top (at the 100 foot level) is 4 feet of gravel, with sand and loam matrix. The whole is very compact, and its stratification irregular. Beneath the gravel there is at least 18 feet of arkose sand, yellow to white in color, compact and well stratified, with an occasional seam of pebbles. Hills at slightly higher levels (102 feet, 108 feet) have caps of gravel, apparently the upper member of the formation, resting on Cretaceous. These hills appear to represent about the upper level of Pensauken deposition here.

In the large area north and northwest of Moorestown and Hartford, the upper part of the formation has more gravel, and the lower part more sand; but at the very base, gravel is likely to occur. There are many pits where the sand and gravel are worked for road material. One pit shows:

- 3) 2 feet loam and sand with quartz pebbles.
- 2) 8 feet coarse sand, more or less cemented by iron oxide.
- 1) 6 feet sand and fine gravel, well stratified, with occasional boulders 1 foot in diameter, and with bits of red shale.

In the more westerly areas, the difference in constitution is brought out by a few sections. Thus west of Merchantville, a section showed 7 feet of compact gravel and arkose sand of a brownish color, above 4 feet of similar material of lighter color.

At Fish House and Delair extensive excavations have shown a heavy bed of black clay (Fig. 49), overlain in places by typical Pensauken gravel, and underlain by gravel of Pensauken type, quite like that at low levels in Philadelphia (p. 106). The clay contains unionid shells, one species of which still lives in the river in the vicinity.

South of Morris Station, on Pensauken Creek, the place which gave name to the formation, exposures of the formation over the Cretaceous clay are numerous. The following is a typical section:

Fig. 41.

Pensauken formation west of Woodbridge, Middlesex County. Note the fault with displacement of 6 inches (to the right of the trowel).

Fig. 49.

Black clay at Fish House, Camden County. Twenty feet of black clay overlying Pensauken sand (not shown in the photograph). Pensauken gravel overlies this clay in the immediate vicinity, although not in the section here reproduced. The clay contains numerous unio shells.

- 3) 8 feet coarse gravel and brown sand and loam, compact.
- 2) 16 feet coarse brownish sand of arkose type.
- 1) ½ foot coarse gravel and cobbles.

Pebbles and cobbles of crystalline rock are abundant in the gravel, and most of them are so decomposed as to be easily crumbled in the hand. Most of them are well rounded. Bits of red shale of Triassic origin are as abundant as those of all sorts of igneous rock, and are mostly in well-worn disc-shaped pieces; but there are occasional angular pieces of larger size.

In the area about Cinnaminson, the base of the Pensauken has an average altitude of about 60 feet; but at the west it is as low as 30 feet, and elsewhere locally as high as 70 feet, thus showing considerable irregularity. From Cinnaminson the base declines 40 feet in a mile to the northwest, toward Pompeston Creek.

East of Palmyra an exposure in the hill on which the Riverton waterworks stand, a gravel pit at 70 feet, shows 75 per cent. of the stony material of the gravel to have a diameter of less than 1 inch, though cobbles 3 inches in diameter are common. Quartz is the chief constituent (90 per cent.), while red shale and granitic material make about 2 per cent., and chert and quartzite the remainder. The gravel is very compact, and has little sand. In the vicinity, however, other exposures show arkose sand with but little gravel. Near North Pennsville one section showed some clay associated with the sand and gravel. This recalls the phenomena at Fish House.

Near New Albany, the hilltop remnants of the Pensauken occur at elevations which range from 80 feet for the base at New Albany, down to 50 feet at Hunters Hill, 1½ miles to the northwest. At Fairview, the range is from 70 to 90 feet.

The arkose material came down Delaware River, and built up the lowland. This phase of the formation is limited south-eastward by an old scarp at some points, while at others the scarp was broken down, and the northward gravel went up the side valleys a little to the southeast of the general line of the scarp, as in the vicinity of Moorestown.

Southeast of the scarp, the old Woodstown Plain was 30 to 40 feet higher than the Swedesboro Plain. It was cut by valleys

30 to 50 feet deep, which interrupted the continuity of the scarp. The arkose phase of the formation did not extend beyond the Swedesboro Plain.

The Mount Laurel flats.—In contrast with the area southwest of Coopers Creek, a broad area about Mount Laurel and Marlton is low and free from any surface material which can be referred to the Pensauken formation (Fig. 47, p. 136). It is probable that the formation was once here, and that it has been eroded away.

The altitude of the surface in this area is below the level of the Pensauken to the west, much of it considerably below. Various elevations in the region at heights of 80 to 90 feet have a scattering of surface pebbles which suggest the former presence of a gravelly formation. Such suggestions of the pre-Pensauken plain as the surroundings afford would place it at 80 to 90 feet. If this is correct, the present lowland about Mount Laurel, at 30 to 60 feet, is of post-Pensauken origin. This is a singular feature topographically, because the area is distinctly below the general level of the land between it and the Delaware, through which the degrading streams must have passed.

The explanation of the Mount Laurel lowland is probably to be found in two principal facts: (1) The Cretaceous beds which outcrop here are more easily eroded than those which outcrop to the west where the surface, except for the valleys of Pensauken and Rancocas creek, is higher; and (2) the Pensauken once deposited in the area of the present flats was possibly finer and thinner than that deposited by the main stream.

Southwest of Coopers Creek, the area was not equally degraded in pre-Pensauken time, perhaps because the corresponding bed of the Cretaceous is much thicker there than to the northeast. Further, Rancocas Creek seems to have been the largest of the streams from the east, and for that reason to have been most efficient in erosion.

Vicinity of Philadelphia.—In much of Philadelphia the base of the Pensauken is below 40 feet, and in places as low as sea level, and the low-lying part of the formation is somewhat different from the part at higher levels. In the city, the Pensauken

material at 60 to 120 feet is similar to that at corresponding elevations east of the river. That is, it is principally of arkose sand, whitish to yellowish and brownish in color, with seams of pebbles which develop, locally, into beds. The pebbles are on the whole well worn, and many of them well rounded. Some of them are disc-like. Bits of granite and shale are common, and locally abundant. The sandy part of the formation has much resemblance to the decomposed gneiss of the region.

The part of the formation below 40 feet is more gravelly. Sand is subordinate, and not notably arkose. Among the stony materials, angular to subangular pebbles of quartz, quartzite, and sandstone predominate. Boulders and cobbles are more common than at higher levels, and pieces of crystalline rock are more common than above. Shale occurs also, but is less well rounded than at higher levels. This type of gravel has not been seen on the east side of the river, and it has not been seen directly beneath the normal arkose Pensauken; but its relations seem to imply that it is the basal part of the valley filling, over which the Pensauken proper was deposited later.

Between Rancocas and Crosswicks creeks—Delaware phase.—The two phases of the Pensauken are present here in the same relations as farther south. The pre-Pensauken scarp separating them extends from southwest to northeast through Rancocas, Jacksonville, Columbus, and Mansfield, to Extonville, and is essentially coincident with the outcrop of the Englishtown sand (a bed of the Cretaceous), the upper part of which is more or less cemented by iron. The scarp was 20 to 50 feet high at the time of Pensauken deposition. The general section for the region is shown in Fig. 50 (p. 136).

Pensauken deposition here followed the lines already sketched. That is, it began in the channel of the Delaware, and spread back over the valley lowland to the scarp separating the Swedesboro and Woodstown plains. This aggradation in the main valley affected the tributaries, causing them to aggrade their valleys with material brought in from the southeast. Deposition in the tributary valleys appears to have kept pace with that in the main valley.

The larger remnants of arkose Pensauken occurring at the surface in this area lie at and northeast of Rancocas (70 to 90 feet), on the divide between Mill Creek and Assiscunk Creek (60 to 109 feet), in an area about Deacons, on the divide a mile or so northwest of Jacksonville (70 to 103 feet), on the divide east of Bustleton (70 to 109 feet, and east of Bordentown (80 to 120 feet). Smaller areas occur east of Kinkora (above 80 feet), at Mansfield (above 80 feet), a mile east of Fieldsborough (above 80 feet), and a mile southeast of Crosswicks (above 90 feet). In most of these places the formation caps low divides, its base having an elevation of 70 to 80 feet; but in two places it is known to run down much lower. One is at Rancocas Creek, south of Rancocas, where its base is as low as 20 feet locally; the other is southwest of Beverly, where it has been seen in excavations beneath the Cape May formation, where its top has an altitude of 20 feet, and its base probably about 10 feet. Normal Pensauken occurs here, with pebbles of decomposed crystalline rock, red shale, trap, etc. One boulder of trap 3 feet in diameter was seen. The matrix is arkose sand. The low altitude of the remnant here is consistent with the position of the base of the Pensauken at Rancocas and Fish House.

At and near Rancocas, the eastern edge of the Pensauken area appears to lie against the old scarp above the Swedesboro Plain. The material of the formation here is finer than the average, and contains less foreign (northern) material.

Coarser phases of the formation are seen north and northwest of Deacons, in pits where the depth of the Pensauken material is 6 to 10 feet,—probably the lower part only of the formation as originally developed. Its later, upper, and generally finer phase has been removed.

In the area about Deacons Station (Fig. 48), the formation occupies the divide between Assiscunk and Mill creeks. The higher points in this area are to the east, and reach an altitude of 106 to 108 feet. The materials are largely of local (from the east) gravel, including ironstone, quartz, and chert. Ironstone in large pieces is most common at the base of the formation, along with the northern arkose material, and the red shale, which goes

with the latter generally. The ironstone masses were perhaps residual on the surface when the northern materials were deposited on and among them. The upper part of the Pensauken here is not arkose. It would appear that the lands to the southeast must have been higher than now, or at least must have yielded more sediment than now, to have furnished the Pensauken material above the basal layer.

At Deacons Station, extensive excavations reveal the presence of large boulders (up to 4 feet in diameter) of crystalline rock, and slabs of red and black shale 1 and 2 feet in diameter. At this place, the arkose phase of the formation is interstratified with the non-arkose phase. The sources of the materials therefore alternated from time to time, while the lower 10 feet was accumulating. The upper part here is largely arkose. The eastern edge of this area marks the approximate southeastern border of the Delaware (arkose) phase of the formation. Of the coarse material (cobble size and larger) in the formation here, sandstone predominates greatly over all others, in most places. Granite boulders up to a foot in diameter are decayed and soft to the core. Of the finer gravel, quartz is the leading constituent.

A good exposure half a mile southeast of Deacons showed an abundance of granitic and other northern material. Red shale and Stockton sandstone are readily recognized, also slabs of black shale, similar to that at Milford. Ironstone slabs up to 6 feet in diameter occur here,—not masses formed *in situ*, but transported masses showing some evidence of wear. At other pits in the vicinity, notably $1\frac{1}{2}$ miles southeast of Deacons Station, there are seams of clay in the formation, and pellets of clay, arranged in seams. The section here shows 2 feet of compact arkose sand and gravel, under 8 feet of glauconitic sand. The material is coarser at the west and finer to the east, and glauconite, essentially absent at the west, is abundant at the east.

Northwest of Jacksonville, as at many other places, the base of the formation is uneven enough to show that the underlying surface had considerable relief when the formation was deposited.

If the Delaware Valley to the west was built up to a level

which is now 100 feet above sea level, as seems certain, it would seem that Assiscunk Creek should have gone south to Rancocas Creek, if the divide between them had not been higher than now. The fact that it went westward indicates that the divide was higher than now.

The remnants of the formation within a few miles of Riverside suggest a measure of post-Pensauken erosion. At New Albany, remnants occur at 100 feet, and others in the vicinity of Cinnaminson and Deacons, have about the same elevation; the surface here must have been built up to about this height in Pensauken time. At Beverly the base of the formation has an altitude of not more than 10 feet. These figures suggest an original thickness of 90 feet or so over what were the deeper valleys, and at least 30 feet over the pre-Pensauken plain which is now at 70 feet. From these facts and the present fragmentary condition of the formation, some idea may be had of the erosion which has taken place.

In the vicinity of Bustleton, pits reveal the structure and constitution of the formation well (Fig. 31, p. 78). The material ranges from coarse, with occasional boulders 2 and 3 feet in diameter to fine, with nothing coarser than pebbles. In some of the pits the sand is arkose, while in others it is not, or not uniformly so. The structure, too, is variable, suggesting waters of varying strength of current. Within the area there is the same evidence of transition from the northwest phase to the southeast phase that was noted about Deacons.

A mile and a half west of Columbus is a partially isolated area which is topographically the eastward continuation of the Bustleton area. It is covered with a thin bed of gravel, which includes blocks of conglomerate. This is a non-arkose remnant, possibly antedating the deposition of the arkose phase nearer the Delaware.

At Florence there is a small area of Pensauken, which has an altitude of 75 feet to 80 feet. This remnant, like all others near the Delaware, is arkose. Its position indicates that the main valley of the Delaware was not just where it now is in pre-Pensauken time.

There is a considerable area of Pensauken north of *Three Tuns*, and a mile east of Kinkora. The material here is very similar to that at Bustleton. Boulders 2 to 4 feet in diameter are to be seen about the border of the area, and it is inferred that they came from the base of the formation, appearing now where the Pensauken has been removed.

At Mansfield (Fig. 50) and northwest there is a large patch of Pensauken whose base has an elevation ranging from 110 feet at the east to 90 feet at the west. The height of the eastern part here indicates that deposits reached up to the top of the scarp, and perhaps overlapped it. The crystalline rock material is confined to the lowermost 1 or 2 feet of the formation.

Southeast of Mansfield Square is a hilltop (108 feet) cap of the non-arkose phase of the formation. Its topographic position leads to its correlation with the Pensauken. Other small patches of gravel between Mansfield and *Three Tuns* have characteristics similar to those of the larger areas. Such an area occurs at Sharps Station, and another a mile to the northeast.

A large area of Pensauken occurs east of *Fieldsborough*, but exposures were poor when the region was seen. Enough was seen to show that the patch contains much coarse material. The remnant has a surface altitude of about 90 feet, and it is 10 to 20 feet thick.

The area east of Bordentown occupies the divide between Blacks Creek and Crosswicks Creek. The east part of the formation here lies at the base of the old scarp, as at some of the localities farther south. Arkose material rises to 110 feet at least, and perhaps higher. Northern material is more common in the lower than in the upper part of the section, but is not restricted to the bottom. There is some cementation. In the area as a whole there is, as at other points to the south, a distinct transition from mostly arkose at the west, to mostly non-arkose at the east, at slightly higher levels.

A mile west of Crosswicks, on the Bordentown road, a well section seen was as follows:

- 2) 4 feet gravel and loam.
- 1) 20 feet coarse sand, with gravel and cobbles at base.

On the whole, the material of the area is chiefly coarse arkose sand, with coarse gravel, cobbles and even boulders at the base.

In the vicinity of Crosswicks there is a considerable area of arkose Pensauken south of the creek. The character of the material is like that at Bordentown. Its base is at such elevations as to indicate that a valley occupied approximately the site of the present Crosswicks Creek in pre-Pensauken time.

In general the Pensauken is coarser, and contains more northern and arkose material near the Delaware, and is finer, with less arkose material, farther back from the river. At the east, there is local material only; at the west, northern material chiefly; and in a belt between, the two are somewhat mingled and interbedded. The interbedding and intermingling are chiefly along the southeast border of the Swedesboro Plain, near the base of the old scarp which marked its southeastern limit. The Swedesboro Plain here has an altitude of 50 to 80 feet, and is 20 to 40 feet below the scarp to the southeast. The structure of the arkose phase is not unlike the structure of the valley train of the last glacial epoch, above Trenton. The Delaware phase of the formation spread 2 to 4 miles from the present stream. A similar condition of things existed on the west side of the Delaware.

Between Rancocas and Crosswicks creeks; non-arkose phase.—East of the arkose phase of the Pensauken between these creeks, there are many patches of gravel and glauconitic sand, representing the non-arkose phase of the formation. They occur at elevations similar to those of the arkose phase, and slightly higher. Some of the larger areas are at Columbus, on the divides between Jobstown, Juliustown, and Arneys Mount, and on those about Georgetown. The gravel is thin, 4 feet being an unusual thickness, and the material is mostly quartz and ironstone. Glauconitic sand and loam are more abundant than gravel. The altitude of the bases of these patches ranges from 50 feet up to 130 feet. Their correlation with one another, and all with the Pensauken, is open to question, but many of them are at the level of 80 to 90 feet, which makes their reference to the Pensauken reasonable.

A cross section drawn from Timbuctoo (a mile west of Mount Holly) to Chesterfield, crosses six of these patches of uncertain Pensauken, with their bases ranging from 55 to 85 feet. All of them lie on or close to the outcrop of the same bed of the Matawan group. Along a parallel section farther west, through beds of the Delaware phase of the formation, the bases of the Pensauken remnants have elevations of 65 to 85 feet. The first series of beds therefore corresponds fairly well with the Pensauken remnants in elevation.

If a section from Rancocas village to Crosswicks village (farther from the Delaware) be so drawn as to include the bases of various Pensauken remnants, these bases have slightly greater altitudes, 80 to 108 feet. That is, the bases of the eastern beds of arkose Pensauken are higher than the bases of the *non-arkose* remnants still farther east. But the belt from Rancocas to Crosswicks, where the bases are highest, is the belt where the most resistant member of the Matawan formation comes to the surface. It is believed that this outcrop had not been brought down to the pre-Pensauken peneplain, when the Pensauken deposition began.

It is certain that the region to the west was built up to the level of the Rancocas-Crosswicks section, and it is probable that the region to the east was equally aggraded. On the other hand, it is conceivable that this low-level belt (Timbuctoo to Chesterfield) was not built up to the level of the Delaware plain in the Pensauken epoch. If so, a marsh or even a lake might have developed east of the main belt of Delaware deposition. Perhaps the green loams are a product of this condition. On the whole, however, the flat low lands northeast of Mount Holly are probably to be explained the same as those about Mount Laurel.

West and northwest of Juliustown, Pensauken gravels, etc., cap divides between the branches of Barkers Brook, at levels of 100 feet and less. This area has 4 to 8 feet of gravel and sand, lying on Cretaceous. The stony material is quartz, chert, and ironstone, not very distinctive. The correlation of these areas is doubtful, and they are regarded as Pensauken on the basis of position only.

North, west, and south of Fearings Mount, hilltop patches of gravel at $120 \pm$ feet are to be correlated with each other, and perhaps with the Pensauken. The amount of gravel is small, but perhaps enough to suggest the approximate altitude of the Woodstown Plain. At other places in the vicinity, bare Cretaceous appears at about the same level. Glauconitic loam is more conspicuous than gravel at the surface in much of this area. The gravel is limited to the contact of the Cretaceous and the sandy loam above. The slopes above and below 120 feet are more commonly bare Cretaceous than are surfaces at about that level. Similar areas occur on the divides west of Jobstown.

In the vicinity of Georgetown are numerous small patches of gravel classed as Pensauken. These range up as high as 140 feet, but are thickest somewhat lower. Half a mile south of Georgetown a pit shows 6 to 8 feet of gravel, with a mixture of glauconitic sand and marly loam. Seventy-five to ninety per cent. of the gravel is of ironstone, mostly fine, but with some coarse gravel and cobbles. In the sand of the formation, grains of the sort common at the contact of the Navesink and Mount Laurel formations are abundant, showing the source of same at least of the material of the sand. Other exposures of gravel west of Georgetown show the same general features. All about here, the matrix of the gravel is glauconitic sand and marly loam. The ridge northwest of Jobstown, and between Barkers Brook and Assiscunk Creek has a heavy cover of it. The next divide to the southwest has less, but enough to conceal what is below, so as to make correlations difficult. Glauconitic sands in the surface deposits are also common over most of the area between Mount Holly and Georgetown, where they run up to 120 feet, and on Arneys Mount even higher. A similar glauconitic mantle appears in the valley of the Rancocas south of Arneys Mount, and in the valleys of Crosswicks and Blacks creeks to the northwest of Georgetown.

This surface green loam is doubtless connected in origin with outcrops of Cretaceous beds of marl, but the conditions of its deposition are not altogether clear. It is conceivable that the upper parts of the valleys in this region were not aggraded as

fast as the lower parts, and so in the more or less ponded waters, the marly material from the uplands accumulated in marshy tracts. This hypothesis is, however, not altogether satisfactory, for distinctive lacustrine deposits are wanting.

Along the Assiscunk Creek and Barkers Brook, in the vicinity of Jobstown and Jacksonville, glauconitic sands are accumulating as ridge-like beds bordering the present streams, which head back in the marl beds, whence they derive their greensand. During floods, these streams deposit the greensand on their flood plains several feet above the ordinary stages of water. When the flood-plain becomes dry, the greensand is blown about, in many cases to higher levels, and piled up into low dune ridges. The ridges now seen are slight, rarely more than 3 or 4 feet high. It seems therefore quite possible that floods and winds may have been important agents in the distribution of the greensand loams. It is also probable that they did not all originate in one way or at one time.

Along Blacks Creek there are numerous patches of gravel between Jacobstown and Chesterfield which may or may not be of Pensauken age. Some of them appear to be younger. They are characterized by local (southeastern) gravel, in which ironstone and glauconitic sand are conspicuous elements. Materials from the Navesink marl and the Kirkwood sand can be recognized distinctly in some places. Glauconitic loam overlies gravelly, glauconitic sand in many places. On the whole, the sections along Blacks Creek above Chesterfield show more gravel up stream, and less below.

Along this creek there are gravels and sands of undetermined age. Some of them seem younger than the Pensauken, and older than the Cape May. Gravels of intermediate age are of course quite possible. There are small beds of gravel classed as Pensauken on benches at an altitude of $100 \pm$ feet, a mile or so south of Chesterfield.

Northeast of Woodstown, the Woodstown Plain appears to have terminated somewhat abruptly against a scarp such as that now seen east of Juliustown, west of Fountain Green, at Spring-

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field and Jacobstown. The isolated hills at 125 to 130 feet, south of Chesterfield, are perhaps outliers of this scarp.

CROSSWICKS CREEK TO RARITAN RIVER.

General statement.—From Allentown and White Horse northeast to South River, the Pensauken forms a nearly continuous cover, being interrupted only by the valleys of the larger streams flowing northwest,—Pond Run, Miry Run, Assanpink Creek, Bear Brook, Millstone River, Cranbury Brook, Lawrence Brook and some of its branches. Newtown, Hamilton Square, Dutch Neck, Hightstown, Cranbury, Prospect Plains, Dayton, Dunhams Corners, and Hardenbergh Corners, are on the Pensauken plain; Princeton Junction, Monmouth Junction, and New Brunswick are on its northwestern border; and Jamesburg and Old Bridge, on its southeastern border (Fig. 55).

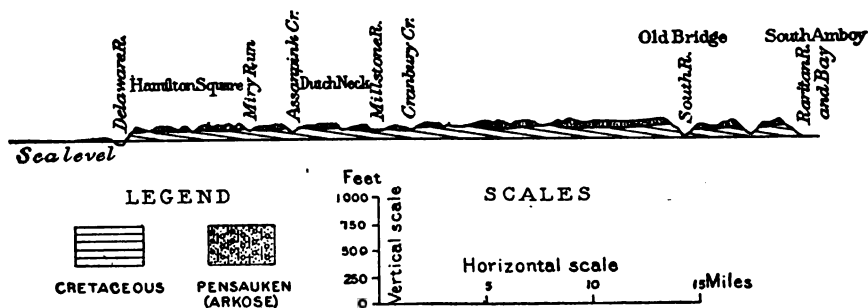


Fig. 55.

Section through Hamilton Square, Dutch Neck and South Amboy, showing relations of the Pensauken formation.

Northeast of Bordentown, the two-fold division of the pre-Pensauken surface (Swedesboro and Woodstown, p. 91) has not been recognized, and the scarps to the southeast of the main Pensauken area were less well defined. In place of a well-defined scarp, there were numerous headlands projecting out from the southeast. These headlands were probably the remnants of a scarp dissected by erosion. To the southwest, where the scarp (the outcrop of the Englishtown sand) was more continuous, it limited the arkose Pensauken. To the northeast,

where it was not continuous, the broad valley of Assanpink Creek extended eastward far beyond the line where the scarp would have been, and the arkose Pensauken was carried up this valley to New Sharon and beyond. The northern material (arkose, red shale, etc.), is chiefly at the base of the formation, nine-tenths of it probably in the lowermost 5 feet. It is clear that the northerly material was the first to come into the region, but it soon gave place to local material from the southeast. The belt within which arkose Pensauken occurs here is greatly widened, as compared with the area farther southwest. The great widening occurs at Crosswicks Creek, and the arkose phase of the formation extends east to Extonville and New Sharon.

Near Crosswicks and Doctors creeks.—Between Crosswicks Creek and Doctors Creek, south of Allentown, there is a large area of Pensauken, the surface of which has a maximum altitude of 126 feet. Its base has an elevation of about 60 feet near the stream, and about 90 feet back from it. The pre-Pensauken valley here appears to have been rather wide, and shallower than the corresponding valley of the Rancocas. The formation here has a thickness of about 30 feet. A bed containing coarse cobbles probably lies at its base, for about the borders of the area, cobbles appear where the body of the formation has been removed. Exposures show the usual arkose gravel and sand on Cretaceous clay. A mile south of Allentown, arkose sand occurs up to the top of the 126-foot hill. The surface of part of this area is mantled with eolian sand and loam, which conceals the true Pensauken material beneath.

In the village of Allentown, what appears to be Pensauken gravel has been seen poorly exposed in the south bank of the creek. The material is more or less cemented at the level of the pond, 60 to 65 feet. This and some other exposures farther down the creek suggest that Pensauken material may lie below the Cape May deposits here.

There is a considerable area of Pensauken east and northeast of White Horse, rising above the 90-foot level. It rests on the Raritan formation, as seen in numerous exposures. Its surface declines to the northwest, and the formation passes beneath the

Cape May formation at an elevation of about 60 feet. The Pensauken is traceable westward by means of excavations, and in ravines, to within three-fourths of a mile of the Delaware, where its upper surface, beneath the Cape May (Trenton gravel) formation, has an altitude of 20 to 30 feet. Pits south and west of White Horse show the material to be very compact, but not very coarse gravel, of a reddish-yellow color. Large cobbles and even boulders occur on the surface, doubtless left there by the removal of part of the formation. The surface here is characterized by many undrained hollows, comparable to those in the surface of glacial drift, where its topography is relatively plane.

The Mercerville-Robbinsville-Allentown area.—The surface of this area has an altitude ranging from about 100 feet at the west, to about 140 feet (maximum 153 feet) at the east. At the west the base of the Pensauken has an altitude of about 80 to 90 feet, but is as low as 70 feet, or possibly 60 feet, at some points near pre-Pensauken valleys.

The base rises to 90–95 feet at Robbinsville, and 120–130 feet at points on the eastern border of the area, near New Sharon. Where the Pensauken occurs at the lower levels on slopes, it is possible that it has been displaced down slope since Pensauken time. The base appears to remain relatively low (90 to 95 feet or less) to a point $2\frac{1}{2}$ miles east of Robbinsville, where it rises rather promptly to 130 feet along the site of what was probably an old headland extending northwest from Egg Tavern.

In this general area the Pensauken is arkose, and contains bits of crystalline rock, shale, etc., as normally. It has a depth of 30 or 40 feet, maximum, but its average is much less.

A good exposure on the railway near Robbinsville showed:

- 3) 2 feet of quartzose sand and loam.
- 2) 6 feet of horizontally stratified gravel and sand, with pockets of
3) sunk into its surface.
- 1) 7 feet of coarse arkose sand, somewhat cross-bedded, with bottom
not seen.

Two miles southwest of Robbinsville, in the north bank of Back Creek, at 60 feet, the material is much coarser, cobbles, and

small bowlders (up to 1 foot) being abundant. These cobbles and small bowlders have been gathered in large numbers along some of the fences. Between Robbinsville and Yardville, similar stones are common over the surface. They are the relics of Pensauken that is gone.

The characteristics of the formation in the vicinity of Robbinsville hold to the northwest; but the materials become coarser in that direction, and the proportion of granitic and Triassic material increases, though not uniformly.

A mile and a half south of west of Hamilton Square, at the road corners, there is a bowlder 4 feet in diameter. The surface hereabout is characterized by occasional undrained hollows, drift fashion. Raritan clay lies close beneath, and its movement, resulting from its plasticity, is perhaps responsible for this element of the topography.

Between Assanpink Creek and Miry Run.—The Pensauken here has a surface altitude ranging from 70 feet or so up to 100 feet or slightly above. Locally, the formation is hard to distinguish from its Cretaceous base, especially where the latter is sand.

Shrewsbury, Wrightsville, and New Sharon.—About Shrewsbury and Wrightsville there are, within a few miles' radius, a number of gravel-capped hills. The gravels are of southeasterly origin, and their age is somewhat uncertain. Knapp regards them as probably Pensauken, but they may be older. The hilltops about Shrewsbury range from 140 to 155 feet, and those about Wrightsville up to 190 feet. Larger areas of possible Pensauken occur just south of Shrewsbury and Egg Tavern, and at Wrightsville. These larger patches are on slopes, and are younger than the hilltop caps. Their exact age does not appear to be determinable. If the hilltop caps are Pensauken, these are younger; if the hilltop caps are older, these may be Pensauken.

On the divide at Davis Station, and extending both east and west, is a body of non-arkose Pensauken at an elevation of 140 to 148 feet. One section seen here shows:

- 2) 2 feet of slightly gravelly loam.
- 1) $3\frac{1}{2}$ feet of indistinctly stratified gravel and sand. Some layers have much loam as a matrix for coarse sand, others are chiefly of loam or marly loam; glauconitic.

The stony material is made up of quartz, chert, and ironstone. Other sections near vary but little from the above. Other patches of gravel regarded as Pensauken occur at Cream Ridge ($150\pm$ feet) and east of Imlaystown, at about the same elevation.

Near New Sharon there are two patches of Pensauken. That east of the railway is mostly non-arkose, that west of the railway arkose. Their bases are at about 90 feet, and their surfaces run up to about 130 feet.

Trenton and vicinity.—A mile or less east of that part of Trenton known as Chambersburg, and also 4 and 5 miles northeast of Trenton, there are small areas of Pensauken rising up through the Cape May formation. The tops of these areas, one of which is in the Fair Grounds, are above 60 feet, the upper level of the Cape May, represented here by late glacial gravels and sand. Pensauken underlies considerable parts of the Cape May formation about Trenton, running down to levels as low as 20 feet, and probably down to 10 feet (Fig. 33, p. 54).

North, northeast, and northwest of Trenton, there are numerous areas of Pensauken resting on the Newark series. They cover much of the area below an elevation of 120 feet, in the area roughly outlined by Trenton, Asylum Station, Lawrenceville, and Princesville. The northwestern border of the Pensauken here is well defined, just as its western border is at Philadelphia, where the edge of the formation is on gneiss and schist.

The base of the formation in these areas is 80 to 90 feet above sea level at the south (in the north part of Trenton), and rises to 120 to 130 feet to the north and northeast. Its remnants in this vicinity, considered in connection with those to the southeast, show the existence of a pre-Pensauken valley in the general position of Assanpink Creek, at or near the southeast border of the outcrop of the Newark series. This valley was as low as the present 20-foot level at Trenton (possibly lower), and probably below 30 feet at Bakers Basin, 6 miles northeast of Trenton.

The valley was wide, and its southeastern slope was gentle, declining from an elevation of 80 or 90 feet at Edinburgh and Hamilton Square at the southeast, to $30\pm$ feet at Bakers Basin, and 10 or 20 feet at Trenton, at the northwestern edge of the Cretaceous terrane.

The upper limit of the formation northeast of Trenton is at about 130 feet, along a fairly well defined line, and this appears to have been its original upper limit. Northwest of the 130-foot contour, the Newark shale surface rises somewhat promptly to $200\pm$ feet. There appears to have been a somewhat definite though low and gentle scarp at what is now the level of 130 feet, when the Pensauken gravel was deposited. Below this scarp there was an ill-defined bench, whose northwestern margin has now an altitude of about 120 feet, and whose southeastern margin had an elevation of about 90 feet. On this bench, Pensauken gravel accumulated.

At higher levels (up to 190 or so) in this vicinity, as about Ewingville and between Pennington and Lawrenceville, there are cobbles and even good-sized boulders over the surface. These are interpreted as relics of an older formation, perhaps the Bridgeton, which once overlay this region, but which is now gone except for these relics. These boulders and cobbles are somewhat different from the coarse materials of the Pensauken. Stated in other terms, the Pensauken contains certain types of stony matter not known at the higher levels.

The shale surface beneath the Pensauken north of Trenton does not show valleys comparable to those of the Cretaceous surface beneath the Pensauken to the southeast. The 120-foot bench northeast of Trenton is probably very definitely related to the 90-foot base of the Pensauken in the vicinity of Allentown, Newtown, Hamilton Square, and Edinburgh. If these two levels in these localities are parts of one plain, the Cretaceous part of the plain was 5 miles wide southeast of Trenton, and 8 miles wide between Princeton and Hightstown. The corresponding bench in the Newark was much narrower, 3 miles at a maximum, and in some places as little as 1 mile.

- The material of the Pensauken formation north and north-east of Trenton is essentially the same as in the areas north of Crosswicks Creek, already described. The stony material is chiefly of quartz and sandstone, with a little Newark shale and a little crystalline rock. The amount of shale present varies much from point to point.

On the hypothesis that the Pensauken is a marine formation, the 130-foot line marking its upper limit was the shore line of the sound which extended from Trenton to Raritan Bay. In this case, the shore gravels should have been largely of red shale. While this is true in spots, it is not the rule, and though the constitution of the gravel is perhaps not altogether decisive, its suggestion is rather that the gravel along the original border of the formation was not derived by wave action from a shore of shale.

Southeast of Asylum Station, some sections of Pensauken show much clay, mingled with plentiful cobbles and boulders, among which brownish quartzitic sandstone, white conglomeratic quartzite, and Stockton conglomerate are most conspicuous.

A mile and a half south of Lawrenceville, a Pensauken section shows:

- 3) 3 to 4 feet of gravel, the stony matter imbedded in clay and loam.
- 2) 1 foot of red shale gravel, little worn.
- 1) $\frac{1}{2}$ to 2 feet of red shale gravel, mixed with quartz, very compact.

In the uppermost member, the stony matter is made up of about one-third chert, one-third quartz, with sandstone, quartzite, and shale in decreasing proportions in the order named. At numerous points in the area between Trenton and Princesville, the Newark conglomerate, when decayed, has a superficial resemblance to the Pensauken, and might be mistaken for it on hasty inspection.

At Clarksville there is an area of Pensauken on the divide between Port Mercer and Lawrence Station. Locally at least it contains much red shale. Similar gravels occur at other points to the northwest, but in none of these places do the gravels contain more red shale than at one point south of New Sharon, 9

miles from the nearest shale outcrop. Conditions of deposition were therefore such as to permit the deposition of red shale gravel, in quantity, at this distance from its source. The shale could hardly have been carried across a sound, unless by floating ice.

Between Assanpink Creek and Millstone River.—In the vicinity of Princeton Junction, the crystalline rocks are but thinly covered with Pensauken, the contact being at an elevation of about 90 feet. To the south the Pensauken is thicker, covering uninterruptedly a broad area which extends through Dutch Neck to Edinburgh, Windsor, and Allens Station. From an elevation of about 90 feet at Princeton Junction, its surface rises to an elevation of about 150 feet near Allens Station. Only at the extreme southeast, however, is much of the surface above 130 feet.

Within this area, the lowest level of the base of the formation is not at the contact of the Cretaceous with older formations, but along a line running northeast from Mercerville, through Dutch Neck and Grovers Mill, to Plainsboro. Along this line the base of the Pensauken is below 70 feet at many points, and perhaps all the way. This would seem to place the lowest part of the pre-Pensauken surface a mile or two southeast of the surface contact between the Cretaceous system with the Newark series.

To the southeast, about Newtown, Windsor, and Hightstown, the drainage was from the southeast to the northwest. It is clear that between these points and the northwest edge of the Cretaceous, these streams must have turned either to the northeast, to the lower Raritan, or to the southwest, to the Delaware. There was a deep valley between Trenton and Bakers Basin, but its continuation to the northeast has not been traced.

There was a considerable pre-Pensauken valley between Princeton Junction and Penns Neck, and it is probable that at this time the Millstone went southwest from Princeton Junction through Bear Swamp to Port Mercer, and thence southwest to Trenton, though it may have flowed north nearly to Princeton, and then southwest between Penns Neck and Princeton to Port Mercer.

Bear Brook has cut through the Pensauken, and exposes the Cretaceous formations in its channel, thus separating the Pensauken area northeast of this valley from that between it and Assanpink Creek. Above the headwaters of Bear Brook, however, the Pensauken cover is uninterrupted, and is continuous between Hightstown, Allens Station, and Windsor. South by east of Hightstown, small areas of Pensauken have been isolated by the valleys of the Millstone River and its tributaries.

Southeast of Hightstown the Pensauken is limited rather abruptly by the rise of the Cretaceous surface up to levels above that reached by the Pensauken. The prompt rise of the Cretaceous surface here probably corresponds to the scarp farther southwest, through Swedesboro, Woodbury, Haddonfield, Moorestown, Jacksonville and Allentown.

Between Assanpink Creek and Millstone River good exposures of the Pensauken are less common than in areas where the remnants are more isolated. About Dutch Neck, for example, exposures are few. The surface shows a few cobbles and an occasional boulder, one over 4 feet in diameter. Such data as are available indicate a thickness of less than 20 feet for the formation in this region. Its general relations in this region are shown in Fig. 51 (p. 136).

Near Edinburgh the surface of the Pensauken is affected by undulations like those already noted at a few points to the west, and more conspicuously at a few points to the northeast, as about Fresh Ponds, Dunhams Corners, etc. On the slope to the Assanpink, $1\frac{1}{4}$ miles northeast of Edinburgh, the surface gives the effect of having low ridges 4 to 8 feet high, much tangled, with undrained depressions between. The open question is whether the ridges are constructional, or whether the substratum, by unequal sinking, moving, etc., has given rise to the undulating surface. One of these curious areas occurs three-fourths of a mile east of north of Edinburgh on the road to Dutch Neck, and similar topography occurs a mile or more west northwest of Locust Corner.

A section of the Pensauken north of Locust Corner in the south bank of the Millstone shows:

- 4) 3 feet of gravelly loam.
- 3) 1 foot of coarse stratified sand.
- 2) $\frac{1}{2}$ foot of gravel.
- 1) 5 feet of coarse arkose sand, horizontally stratified.

Between Locust Corner and Hightstown exposures are rare. Some cobbles mark the surface, and one angular sandstone boulder 6 feet long was seen.

In Hightstown the base of the Pensauken has an altitude of between 90 and 100 feet. Northwest of Locust Corner, and again a mile down stream, Pensauken occurs repeatedly at levels below 90 feet. A mile north of the Corner, the base is below 80 feet, and where the wagon road east from Princeton Junction crosses the Millstone, the base is apparently below 70 feet. These elevations show that the pre-Pensauken base declines gradually from the southeast to the northwest, the most abrupt change being at the southeast, where the formation comes against the old headlands.

The character of the Pensauken at Hightstown is essentially the same as at Allentown and Robbinsville,—light-colored arkose sand, with some pebbles scattered through it. It is, or has been, well exposed in the railway cuts in the vicinity. To the eastward, arkose sand occurs even to Etra, a mile and a half southeast of Hightstown, where this phase of the formation grades into the non-arkose phases farther east. In general, the arkose phase is limited at the southeast by the interrupted scarp referred to, a scarp which consisted of headlands separated by valleys 30 to 50 feet deep, and 1 to 3 miles wide.

The vicinity of Hightstown, contrasted with the region farther southwest, as at Allentown, shows one important difference. In the latter place, the Pensauken is arkose in its basal parts only, while near Hightstown it is arkose up to altitudes of 130 feet, or even to 150 feet. The 151-foot hill a mile and a half south of Hightstown, covered with arkose sand, suggests that the Pensauken was built up to this level in this vicinity.

Two miles south of Hightstown, Cretaceous sand appears at the surface at the top of the 153-foot hill and on the slopes below, while a mile to the northwest, the 151-foot hill seems to be

covered with Pensauken gravel to the depth of 20 to 30 feet. A mile or so south of Hightstown, the Pensauken is some 30 feet thick where the surface has an elevation of about 130 feet. These facts show how abruptly the thick body of the formation terminates at the southeast. The pre-Pensauken surface seems to have risen 40 feet at least in half a mile along the east edge of the Pensauken formation. The relations are similar to those at Swedesboro, where the high-level Pensauken drops off from 115 feet, to the low-level phase of the formation, at 70 or 80 feet.

East of Hightstown, a considerable area of Pensauken covers the divide between Millstone River and Rocky Brook. Arkose sand in its various phases is exposed at several points here. The general disposition of the formation between Swedesboro and Hightstown is shown in Fig. 52 (p. 136).

Between the Millstone River and Cranbury Brook.—The broad low divide between these streams is covered continuously with Pensauken from Old Church and Red Tavern on the southeast, nearly to the junction of the streams. The elevation of its base is about 120 feet at Red Tavern, but declines rapidly to 90 feet to the northwest, and then gradually to 70 feet. The surface is characterized by some cobbles and boulders, among them trap, and in places by the undulatory topography already noted near Edinburgh. Such an area occurs $3\frac{1}{2}$ miles west of Cranbury Station, at the 100-foot level. A trap boulder 4 to 5 feet in diameter occurs southwest of Cranbury Station, in the valley. This is some 9 miles from the nearest outcrop of trap. These trap boulders, as well as the others of the region, are doubtless from the Pensauken, and appear most commonly where that formation has been mostly eroded away.

Outlying areas of Pensauken.—Northwest of the Pennsylvania Railroad there are a few outliers of the Pensauken formation. The largest is at Penns Neck, capping the higher part of the tract between Millstone River, Stony Brook, Duck Pond Run, and the railroad. This Penns Neck area appears to have been surrounded by the drainage of the last glacial epoch, making it an island.

There is no indication of a pre-Pensauken valley between Penns Neck and Princeton, lower than 90 feet. Nowhere else in the immediate vicinity is the Pensauken as low as at Princeton Junction. Its base here is about 80 feet above sea level, rarely below 70 feet.

Small remnants of Pensauken occur at about 120 feet southwest of Princeton, and at 100 to 108 feet south of Port Mercer. The Pensauken mantle here is thin and contains much shale. Locally more than half the material is of this sort. Some of the shale-gravel beds suggests, but do not prove, shore action.

Two small patches of Pensauken occur at Lawrenceville, at an elevation of about 120 feet. Larger areas are on the divide at an elevation of about 120 feet a mile and a half east of Lawrenceville, and on the divide at 100 to 110 feet between Port Mercer and Lawrence Station, centering about Clarksville (p. 122).

There are also outlying areas of the formation to the southeast. East of New Sharon, Allens Station, Hightstown and Cranbury Station, there are several small outlying areas of non-arkose gravel, correlated with the Pensauken. They have no distinctive features, as compared with similar areas farther southwest.

Just east of New Sharon, east of Allens Station, just south of Etra (Milford), and at Old Church and Red Tavern, the arkose Pensauken grades into non-arkose, and the Cretaceous base rises rather promptly at the same time. Farther east the gravel remnants regarded as Pensauken are isolated and higher. Southwest of Red Tavern, the arkose phase rarely is higher than 130 feet, but the non-arkose phase rises to 150, 170 and 180 feet, toward the Clarksburg-Perrineville hills. East of these hills, along the Millstone, Pensauken gravels rise even to 200 feet in a belt extending from Bergen Mills on the north, to within a mile of Charleston Springs on the south. These gravels appear to be associated with the Millstone River in origin.

Between Cranbury Brook and Fresh Ponds.—Within the area roughly outlined by the villages of Plainsboro, Cranbury, Union Valley, Jamesburg, Rhode Hall, Fresh Ponds, Deans, and Mon-

mouth Junction, the surface is generally deeply covered with the Pensauken formation. Its surface elevation ranges from about 70 feet at Plainsboro to about 150 feet between Prospect Plains and Jamesburg, and to 170 feet south of Jamesburg, where the non-arkose phase of the formation appears. Between Jamesburg and Englishtown its surface is still higher.

In the vicinity of Jamesburg, its base is at 90 feet, and the formation is 30 to 50 or 60 feet thick. It is well exposed both in road cuts, and in the large excavations along the railway southwest of Jamesburg. Nowhere else is its composition better seen. One of the striking things shown by the excavations along the railway is the presence of a few boulders up to 3 feet in diameter near the base of the formation. The pebbles and cobbles of crystalline rock are decomposed, but the large boulders are in some cases solid except for a thin layer on the outside. In the case of boulders seen in the bottoms of pits, however, a part of the weathered, decomposed exteriors may have sloughed off. Red shale, ranging in size from small bits to slabs a foot or so in diameter, accompanies the bits of crystalline rock. The upper part of the formation appears to have been derived almost wholly from the southeast, and the non-arkose phase of the formation is therefore all that is seen where excavations are shallow.

The section along the railroad exposes some 30 feet of sand and gravel. The uppermost 6 to 10 feet is loamy, and rests with uneven contact on the sand below. The succeeding 20 feet is sand with some gravel, among which bits of granite and red shale occur rarely. Gravel is subordinate to sand in some such ratio as 1:3. The sand is glauconitic, thin seams highly so. Here and there cementation has taken place at the base of the formation. Among the boulders, sandstone and quartzite predominate, but one of gabbro 3 feet in diameter was seen in the bottom of the pit. Its source is not known, but no formation from which it could have come is known within the State.

A mile southwest of the railway pit, a well at the 150-foot level, dug to a depth of 70 feet, showed about 50 feet of non-arkose Pensauken, over 10 to 15 feet of arkose material. The arkose part was strikingly white, as at Old Bridge. This is one

of the deepest sections of the Pensauken known. The well was an open one, and the section was seen from top to bottom. It showed conclusively that the foreign (northern) materials of the Pensauken came in first, and that they were followed by the local, southeastern phase, a conclusion confirmed by hundreds of roadside and hillside sections.

The base of the Pensauken rises from 90 feet at Jamesburg to 120 feet just south of Lower Jamesburg, and to 140 feet at Gravel Hill, 4 miles to the southwest. If, therefore, the Pensauken were removed, we should find the Cretaceous surface rising promptly from 90 feet at Jamesburg, to 120 feet just south of Lower Jamesburg, and 20 feet more, four miles farther south. Available data seem to point to the continuation of the 90-foot plain beneath the Pensauken northwest to Princeton and Monmouth Junction, although the Cretaceous surface rises to $100 \pm$ feet at some points, as $2\frac{1}{2}$ miles southwest of Dayton, along the electric railway.

Southwest of Jamesburg in the vicinity of Prospect Plains and Cranbury, exposures show the same sort of material as about Jamesburg. Toward Cranbury, boulders are rather common on the surface. Three to four miles west of Jamesburg the undulating, undrained surface already noted elsewhere reappears. The same topography recurs, 1 to 2 miles east of Dayton, and it is still more pronounced west of Rhode Hall, and between Rhode Hall and Fresh Ponds. The relief of the surface here is as much as 20 feet in some places, and is so uneven as to recall morainic topography. Near Fresh Ponds, as the name implies, small ponds are common in the depressions, which are 3 to 8 feet deep and the ponds 2 to 10 rods across. The depressions at Fresh Ponds are, however, not so deep as toward Rhode Hall; but the Cretaceous clay is apparently nearer the surface about Fresh Ponds, and so the depressions hold water better. Many of the original marshes and ponds have been drained, and cuts through the rims of the basins have been seen during the process. They are composed of loose gravel and sand, and the same materials lie below the basins themselves where cuts have been seen. The water in the basins is doubt-

less due to the close proximity of the Raritan clay below, and to the general flatness of the region, which does not favor run-off. Some of the gravel and sand, too, has loam enough with it to make it rather impermeable.

Along the creek east of Fresh Ponds, the base of the Pensauken has an elevation of 100 to 110 feet a mile and a half southeast of Fresh Ponds, and 70 to 80 feet a mile and a half to the northwest, at Lawrence Brook. In the immediate vicinity of Fresh Ponds, the Cretaceous has been seen in various excavations at 90 to 100 feet. About Fresh Ponds, and especially toward Lawrence Brook, boulders are common at the surface.

The line of old headlands runs northeast of Allens Station, through Red Tavern, Union Valley, and Half Acre, to Lower Jamesburg. Along this line, the most projecting headland is between Allentown and New Sharon, along the south side of Assanpink Creek.

The Pensauken deposits about Jamesburg show that the formation buried and obscured the earlier topography. The 40-foot relief of the Cretaceous surface near Jamesburg was destroyed by the building up of the low lands to the level of the higher. The phenomena here therefore duplicate those at Robbinsville and New Sharon, except that the upbuilding to 150 feet in the latter place is not altogether conclusive, while at Jamesburg it is; and the latter case seems to carry the former with it. If this is correct, the Robbinsville region was once built up to a level harmonious with that at Jamesburg, and the non-arkose upper part has been largely removed, leaving the arkose part below relatively more conspicuous than it once was.

At the southeast, the levels of the Pensauken at Old Church, Red Tavern, Etra, Allens Station, New Sharon and Egg Tavern, are essentially the same, ranging from 145 to 160 feet. The harmony of these levels and the likeness of the material throughout, point to community of origin.

Vicinity of Monmouth Junction.—Between Monmouth Junction and Princeton Junction, the Newark shale is capped by Pensauken gravel, the surface of which is below 120 feet in most places, and its base is as low as 80 feet just west of Monmouth

Junction. Both northwest and northeast of Monmouth Junction its base is at about 100 feet, but toward Dayton, data from wells indicate that its base is at about 90 feet.

It appears therefore that there was a pre-Pensauken plain about 5 miles wide between Jamesburg and Monmouth Junction, the surface of which had little relief. This surface now has an altitude of about 90 feet. This 90-foot lowland appears to have been aggraded some 50 to 60 feet by the deposition of the Pensauken formation.

The area west of Old Bridge.—This area is but a continuation of that to the southwest, nearly cut off from it by the valley of a tributary to Lawrence Brook. The Pensauken formation is well exposed at Old Bridge, Hardenbergh Corners, and a few other points, and its disposition and relations are shown in Fig. 53.

Between Rhode Hall and Old Bridge the base of the Pensauken has an altitude of about 100 feet. At Old Bridge, the uppermost 6 to 10 feet of the formation is gravelly, chiefly quartz and chert, and very compact. The basal member is coarse sand, slightly arkose, and having a coating of white kaolin about the grains in many places. This gives the sand a singularly white appearance. In other places the gravel and sand alternate. The formation is, at a maximum, 50 to 60 feet thick in this area.

At Hardenbergh Corners a fine exposure of the formation is seen in the railway cut. The basal part is coarse, with plenty of crystalline rock and red shale, but the main body of the formation is of fine gravel and sand. A granitic boulder a foot in diameter was seen here, decayed and soft to the center. Trap boulders, one of them 3 feet in diameter, are decomposed at the surface only. At this point there is a bed of coarse gravel near the center of the section, with 10 to 15 feet of coarse arkose sand below, and sand with but little gravel above.

Northwest of Dunhams Corners, the Pensauken has been largely removed by Beaver Dam Brook and other tributaries to Lawrence Brook. Along the northwest border of that which remains, its base rises locally to 110 feet (a mile northeast of

Dunhams Corners), but declines northward toward Lawrence Brook. Along the south bank of Beaver Dam Brook, its base declines from about 100 feet west of Dunhams Corners to 60 or 65 feet at Lawrence Brook. In the valley north of Fresh Ponds, its base declines from about 100 feet south of Dunhams Corners to 80 feet.

In the area about Dunhams Corners there are many depressions without outlets, similar to those at various points to the southwest. Some of the depressions contain marshes and ponds, while others are dry. The ponds and marshes are believed to point to the proximity of Cretaceous clay below, the dry basins to a greater thickness of Pensauken, or to underlying Cretaceous sands, as distinct from clay; but these relations can hardly be said to be demonstrated. The surface about Dunhams Corners shows a good deal of coarse stony material.

East of Lawrence Brook and northeast of Milltown, there are some patches of Pensauken, mostly thin, which represent the basal part of the formation.

The Pensauken surface reaches an altitude of 163 feet at Old Bridge, and its base is at 90 to 100 feet. The upland covered by the Pensauken drops off suddenly to the valley of South River by a scarp, facing southeast.

Lawrence Brook and drainage changes.—Lawrence Brook follows approximately the junction of the Newark shale and the Cretaceous system from Deans to Milltown, a position which suggests its adjustment to structure. Its course most of the way is actually a fraction of a mile off the contact, its channel being in Newark shale (locally trap) most of the way. Judging by the disposition of the Pensauken, there was a valley at the contact of the Newark and the Cretaceous beds in pre-Pensauken time, for remnants of the Pensauken formation occur along this line at lower levels than to the northwest and southeast. This holds down the valley to its junction with the Raritan. The pre-Pensauken valley floor declines from an elevation which is now 70 feet at Deans, to 60 feet at Westons Mills; but the valley was narrower at the latter place than at the former.

Between Fresh Ponds and Dayton is the great Pigeon Swamp, which occupies a broad flat valley. Its altitude is about 80 feet, and its borders on the north and south about 20 feet higher. Exposures of the material beneath the swamp are mostly wanting; but some information was afforded by a drainage ditch through the marsh some years since. This ditch reached Cretaceous clay but a few feet below the surface, and at the west end of the swamp Cretaceous beds rise as high as 70 to 80 feet. The Pensauken appears to have been mostly removed from the area where the swamp is. The stream now flowing through it is small, and apparently inadequate for the work of erosion which seems to have been accomplished. The swamp is quite unlike the valleys of other tributaries to Lawrence Brook, for the others seem capable of having made the valleys they occupy.

Southeast of Pigeon Swamp there is a broad depression, a mile southwest of Rhode Hall, at about 90 feet. It is three-fourths of a mile wide, and opens out into the valley of Manalapan Creek to the southeast. It seems possible that Manalapan Creek flowed through this gap in post-Pensauken time, going on northwest through what is now Pigeon Swamp, to Lawrence Brook. The valley of South River, between Jamesburg and Old Bridge, is probably following a course assumed in post-Pensauken time.

The early post-Pensauken drainage may have been somewhat as follows: 1) A stream flowing northwest from Wickatunk to Old Bridge, joining the Raritan in the vicinity of Sayreville; 2) Manalapan Creek, flowing northwest from Manalapan to Jamesburg, and thence to Lawrence Brook at Deans Station; 3) Lawrence Brook, flowing to the Raritan in a valley in the Pensauken formation, overlying Newark shale. The first of these three streams excavated its valley faster than the last. After it had been sunk through the Pensauken into the Raritan formation, it had great advantage over Lawrence Brook after the latter reached the Newark shale. It is conjectured that a tributary to the Old Bridge-Sayreville stream developed southwest from Old Bridge until it tapped Manalapan Creek in the vicinity of Jamesburg and led it off to its main, now South River. This diversion of Manalapan Creek left the gap southwest of Rhode Hall un-

occupied by a stream, and the valley of the beheaded part of the former Manalapan Creek became swampy (Pigeon Swamp), as a result of the sluggish drainage which resulted from the lessened flow.

Deposits between Lawrence Brook and the Raritan River.—North of Lawrence Brook the Pensauken formation occurs most of the way from Deans to New Brunswick, the Pennsylvania Railroad marking, in a general way, its northwestern limit. Its surface here has an elevation of from about 100 feet to 125 feet. At New Brunswick its base has an elevation of about 110 to 120 feet, but it declines to about 70 feet at Westons Mills.

The formation here is somewhat drift-like in composition, containing much coarse material of northern origin. It lacks evident stratification in places, especially in the railway cuts between New Brunswick and Milltown, at 110 to 120 feet. The material here is very unlike that at Milltown and southeast of Lawrence Brook, and has somewhat the appearance of glacial drift. In many places the gravel is associated with a good deal of clay from the Newark shale, emphasizing its drift-like aspect. The hypothesis has been entertained that the ice at some time reached this latitude, but proof of its truth is wanting.

South and west of New Brunswick (Voorhees, Clyde, and Middlebush) are scattered bits, but not considerable beds of Pensauken material. Large tracts here which are at levels appropriate for the formation are without it, and the reason for its absence is not altogether clear. (1) Was the New Brunswick region built up to 160 feet, the Old Bridge level, and since lowered by erosion, or (2) was this region too high in *Pensauken time*, for the deposition of that formation? In either case there has been much erosion since. A third alternative is that the Old Bridge-Amboy region has been raised a little, relative to the New Brunswick region, since the Pensauken epoch. Which, if any, of these conjectures is correct, is undetermined.

One and one-half miles west of Franklin Park, and $2\frac{1}{2}$ miles east of Griggstown, the 150-foot hill has a cap of 10 feet or so of gravel. A mile north of west of this, the 140-foot hill has a gravel cap very like the gravel and sand about New Bruns-

wick and Metuchen, though containing less shale. These hill cappings are probably Pensauken, though not of the normal phase. They suggest the first of the hypotheses noted above.

A mile and a quarter northwest of Franklin Park there is a 130-foot area mantled by gravel, and half a mile farther northwest there is another area of gravel at the same (maximum) elevation. In all these places the gravel is lower on the north slopes of the elevations than on the south. This may be the result of displacement, though this is not clear.

West of the Millstone River.—West of the Millstone River, and a mile northwest of Griggstown, there is an area of gravel and loam at about 125 feet. The gravel here differs from that to the east, in that it has more small quartz pebbles—rather of the Beacon Hill type. East of the river, sandstones, quartzite, shale, etc., are more prominent. South of Blawenburg, at 120 to 130 feet, there are remnants of gravel like those about Griggstown and Franklin Park.

The above remnants at 120 to 150 feet are perhaps all Pensauken, and indicate a general mantling at this level. So far as this region is concerned, there might be doubt as to the age of the material; but if the preceding interpretations are correct, Pensauken occurs at 160 to 170 at Jamesburg, 165 at Old Bridge, 150 at Rhode Hall, and at 160 feet north of Somerville. In view of this distribution, it is not unreasonable to refer all these remnants to the Pensauken. An alternative view is that the high remnants noted are remnants of the Bridgeton formation, the base of which has an elevation of 130 to 140 feet near Glassboro, and 90 feet at Bridgeton. If, however, this dip were carried northward, it would carry the base of the formation far above the level of these gravels from Franklin Park to Blawenburg. Another alternative is that the gravels referred to are of various ages, and not referable to any one distinct stage of deposition.

One of the most remarkable areas of the Pensauken formation occurs at Kingston on the east side of the Millstone River just south of the gap in the Rocky Hill range. In coarseness, proportion of crystalline material, and decay of boulders, this deposit is unique. Many boulders 1 to 1½ feet in diameter are

decayed to the very center; while others have a 2- or 3-inch core which is firm. A large part of the thick deposit is of large cobbles, yet there is matrix enough so that the material stands with vertical faces year after year. The gravel fills a river gorge from an elevation of 50 or 55 feet up to 100 feet, and then spreads out on the higher land to the east of the gorge. The gravel came from the north, and apparently it must have been brought in by a stream which flowed south. Down to this point the river must have been swift to have brought in the coarse material, which becomes finer and finer with increasing distance from the gorge. The southward connection of the valley of the stream which deposited the Kingston gravel is not known.

Pensauken gravel and sand cover much of the area between Monmouth Junction and Kingston northwest of the Pennsylvania Railroad. The base of the formation here has an elevation of 80 to 100 feet, being highest at the west.

North of the Raritan.—The Pensauken is well developed in a triangular area roughly outlined by lines drawn between Metuchen, Bonhamtown and Piscataway. It covers the contact of the Newark and Raritan, overlapping it in both directions. Mill Brook and the lower end of Piscataway Creek have cut through the Pensauken and have their channels in the Newark shale. When Pensauken deposition took place here, remnants only of the Raritan formation remained, and the Pensauken buried Newark and Raritan alike. The general disposition and relations of the formation between Metuchen and South Amboy are shown in Fig. 54.

The surface of the Pensauken now slopes from a maximum elevation of 134 feet near Metuchen, to 100 feet or less at Bonhamtown; in other words, it has a gentle slope to the southeast. The base of the formation is lowest along a line southwest from Bonhamtown, and higher to the southeast and northwest of this line. The belt where the base is lowest doubtless marks the site of a pre-Pensauken valley. Mill Brook follows this old valley more than a mile southwest of Bonhamtown, and there it turns south and follows a post-Pensauken valley to the Raritan.

Along the old valley, the Pensauken base has an elevation of 60 feet or so, and on either side it is about 20 feet higher. The stream in this old valley flowed to the southwest, joining the Raritan valley somewhere near the lower end of the present Piscataway Creek.

Between Highland Park and Metuchen, the ragged edge of the Pensauken shows much coarse gravel on the shale, left as the edge of the formation was removed. The material of the Pensauken is coarser west of Mill Brook than is its wont, and has such features as to raise the question whether it is not the remnant of a drift sheet older than that which made the well-developed moraine from Metuchen to Perth Amboy.

A quarter of a mile southeast of Piscataway, at the roadside, the Pensauken section is as follows:

- 3) 3 feet gravelly sand with seams of red loam (doubtfully Pensauken?)
- 2) 20 feet of sand with seams of gravel. The pebbles are largely quartz, but there are many red shale bits and a few granitic pebbles.
- 1) 7 feet coarse white arkose sand with a little gravel.

At Bonhamtown, there is a large gravel pit exposing the formation well. The section is not unlike that at Piscataway, and is somewhat like that at Jamesburg, where 30 to 50 feet of sand and gravel, chiefly from the southeast, overlie 2 to 10 feet of arkose gravel and sand, the two types of material being distinct. At Bonhamtown, however, the arkose and non-arkose types are more or less intermingled, or interbedded, or at least are not sharply separated. As seen in section here, the material at a given level is not arkose, while a short distance away material at the same level is arkose. In no part of the section is the material so free from sand of Cretaceous origin as is the basal part at Jamesburg. It is clear that two different sources contributed to the deposit at Bonhamtown, and that now one and now the other made the larger contribution, while at other times the two were about equal. Stratification is more distinct than at Jamesburg. The sand and the gravel are commonly in nearly horizontal, lens-like beds, a few inches thick. The gravel is

rather fine, most of the pebbles being less than an inch in diameter, though cobbles occur, and rarely a boulder. Among the pebbles are bits of red shale and granite. Most of the sand is yellow and brownish in color, but some of it is white; some of it is arkose.

West of Bonhamtown, on Mill Brook, exposures have been seen which are especially till-like,—so much so as to lead one instinctively to look for striated boulders, but none have been found. Locally red shale constitutes 75 per cent. of the whole.

Another remnant of Pensauken occurs at Sand Hills, east of Bonhamtown, and still other cuts and pits show it to be present beneath the glacial drift near Woodbridge and farther south. Thus a mile or so southwest of the Woodbridge depot, in the 140-foot hill, 40 feet of Pensauken sand has been seen in section. The sand is of the arkose type, yellowish to white in color, somewhat like that at Old Bridge. There is little fine gravel here. The material differs from that at Bonhamtown in being more arkose and less gravelly.

At Metuchen, the Pensauken has been seen well exposed in railway cuts northeast of the depot (Perth Amboy line). Quartz pebbles make up much of the gravel; but quartzite and sandstone are present both as gravel and in larger pieces. Pieces of red shale are common, as are small bits of granite, thoroughly decomposed. In some places the composition of the material suggests glacial drift, but it is in striking contrast with the last glacial drift a few rods to the north.

A mile northeast of Metuchen depot, and three-fourths of a mile east of south of Menlo Park, Pensauken with a distinctly till-like structure has been seen beneath glacial drift; but glacial stones were not found in it.

In the area north of the Raritan and east of the Pennsylvania Railroad, the Pensauken has two somewhat distinct phases: the one, arkose sand; the other gravel in which red shale and granite are prominent. Locally there is much clay with the gravel and boulders, and the structure is somewhat till-like. Though the two phases have not been seen in section, general relations suggest that the sand was deposited first, and the coarser material later; but that in time of origin, the two were not far apart.

Between South River and Cheesequake Creek.—The Pensauken is well developed about South Amboy and Ernston. Its surface reaches an altitude of 170 feet near Ernston, though it rises above 150 feet in but few places. Its base has an altitude of about 90 to 100 feet in most places, thus giving it a probable maximum thickness of about 70 feet.

The section shown along the Pennsylvania Railroad a mile or so southwest of the depot is representative:

- 5) 2 feet moulding sand or loam, locally almost a clay loam.
- 4) 6 feet coarse gravelly sand.
- 3) 15 feet yellow arkose sand free from gravel.
- 2) 6 feet arkose sand, brownish in color, with some pebbles.
- 1) 4 feet of coarse gravel, including occasional boulders; granitic and shale pebbles common.
Cretaceous.

Sections showing material like parts of the above are common. At the crossing of Bordentown Avenue and the Raritan River Railroad, several large boulders (3 feet and less in diameter) have been seen at the base of the formation.

South and west of South Amboy there are numerous exposures at high levels. In general the gravelly material is almost wholly quartz. A three-fold division of the formation prevails, namely

- 3) Quartz-chert gravel, 2 to 15 feet.
- 2) Arkose sand, 10 to 40 feet.
- 1) Coarse gravel, with cobbles and even boulders, bits of shale and granite, $\frac{1}{2}$ foot to 4 feet.

About Ernston and toward Sayreville the material and its relations are the same as at South Amboy.

One and three-fourths miles southwest of Ernston, along the railway near the old Poor Farm, the base of the Pensauken runs down to 20–30 feet, and possibly lower. A quarter of a mile or so farther northeast, the base of the formation is above 90 feet. Again, a little more than half a mile west of Morgan Station, Pensauken is seen at 20 feet. These low-lying remnants do not appear to be displaced, though possibly they are. If not, they mark the position of rather deep pre-Pensauken valleys, like those east of Camden.

The Pensauken about South Amboy and Ernston represents the northwest phase of the formation, as distinct from the southeast phase, a distinction which has held across the State from Delaware Bay to this point. The distinction is as sharp here as to the southwest. The arkose phase of the Pensauken is limited at the south by the valley of Cheesequake Creek.

OUTLYING AREAS OF PENSUKEN, EAST OF SOUTH RIVER.

Northwest of Englishtown.—There is a cap of Pensauken gravel, of non-arkose type, on Gravel Hill west of Manalapan Creek, a mile and more southeast of Hoffmans Station. This connects with the arkose Pensauken south of Jamesburg. Similar gravel covers the divide a mile or so east of Manalapan Creek between Englishtown and Jamestown. The material in the two places is essentially alike, and occurs at similar elevations, and the two areas probably were connected originally. They reach a maximum altitude of 187 feet, and the altitude of their bases ranges from $140 \pm$ feet at the south, to 80 feet at the northwest. They seem to correlate with the main body of the formation to the northwest. The material here is non-arkose, like the upper part of the formation in the Jamesburg railway cut. These areas have their chief significance in connection with remnants of gravel, probably of Pensauken age, about the headwaters of the Matchaponix drainage system, east of Englishtown and north of Freehold.

Southeast and east of Englishtown.—East of South River and Matchaponix Brook there is relatively little material which can be correlated with the Pensauken with certainty. Southeast of Englishtown there are patches of gravel—some small, some large—near Manalapan Creek, above Blacks Mills, and about the headwaters of the creeks which unite to form Matchaponix Brook, as on Monmouth battleground, in the vicinity of Lafayette Mills, Gordons Corners, Union Hill, and elsewhere; or, in general, in an area extending from Robertsville (2 miles west of Wickatunk) on the north, to Blacks Mills (4 miles west of Freehold) on the south. These gravels are below the level

appropriate for the Bridgeton formation, and appear to be stream deposits, left in the general degradation of the region from a higher level. They decline to the west and northwest, in harmony with the present drainage, whereas the Bridgeton of the region is not definitely related to the present drainage, and its base declines to the southeast. Some of these gravels seem to be correlated clearly with the Pensauken to the northwest, while others may be somewhat younger. -Indeed, it does not seem practicable to determine their age with certainty. On the whole, it seems reasonable to regard them as contemporaneous, at least in a general way, with the Pensauken at Jamesburg, and to have resulted from the effects of the deposition about Jamesburg, on the drainage of the area here under consideration.

On the south side of Wemrock Brook, between Englishtown and Freehold, several patches of gravel occur at elevations ranging from 160 feet at the east to 120 feet at the west, on hilltops and divides. The gravel caps are not known to be thick, but the depth of material is rarely exposed. All these gravel remnants lie on a surface some 50 feet below the divide between the Matchaponix and Manasquan systems, on what may be regarded as remnants of a surface which once sloped gently northwestward.

The original Beacon Hill level for this region should have been 350 to 400 feet, so that the Freehold region has been degraded some 200 feet since that time. The gravels along Wemrock Brook were probably derived from the Beacon Hill formation, and left along old stream courses. They are too low for the Bridgeton, and since they agree in level with the Pensauken not far away, they are referred to that formation.

On the divide between Wemrock Brook and the south branch of Tepeheptus Brook, there are other patches of gravel similarly situated. One patch occupies a part of the Monmouth Battleground, where 12 to 15 feet of glauconitic sand and loam overlie 1 to 3 feet of gravel, concealing it in most places. Farther west there are isolated hills at slightly lower levels, capped with gravel. The altitude of these patches ranges from 180 feet near Freehold, to 120 feet in the vicinity of Taylors Mill, a mile east of Englishtown.

Between the branches of Tepeheptus Brook there are other patches of gravel similarly situated, at elevations ranging from 170+ to 110 feet, the higher elevations being to the east, 2 miles or so west of Marlboro. These hills, taken with other patches at similar elevations in the vicinity, seem to point to a widespread accumulation of gravel at a level which is now about 180 feet above the sea in the vicinity of Freehold. It is thought that the gravels here referred to accumulated in the valleys at about this level. The sites of the valleys have been changed since, and their former sites have, in some places, become divides. The base of the gravel in some of these patches about the headwaters of Tepeheptus Brook is very irregular, in a small way, and the irregularities are not unlike those developed in the channels of existing streams.

Between Tepeheptus Brook and Milford Brook and about the headwaters of the latter, the phenomena just described are repeated, the gravels being at similar levels, $170 \pm$ feet. The patches show a tendency to elongation on the divides parallel to the streams. The higher tracts (170 to 180 feet) covered with gravel adjoin still higher lands ($200 \pm$ feet) on the east, east of north of Freehold. These high lands carry some gravels which seem to be older than the remnants at lower levels to the west, though this may be questioned. The high gravels hereabout are cemented to a considerable extent, and so have the appearance of greater age.

Are the gravels between Englishtown and Freehold the equivalent of those northwest of Englishtown? To this question no positive answer can be given. The former have the appearance of having been accumulated in stream valleys, for they vary from valley to valley, in keeping with the terranes affected by the drainage system. West of Englishtown, such a relation is not evident.

If these gravels east of Englishtown were once part of the main body of Pensauken to the west, they would seem to call for the building up of the area between Englishtown and Freehold to $180 \pm$ feet by Pensauken deposits. In this case the remnants we now find at 120 feet are basal remnants of a bed once 60 to

80 feet deep. This hypothesis does not seem to be strongly supported by known facts.

The composition of the gravels northeast of Englishtown suggests (Knapp) that they were deposited after the Beacon Hill (and after the Bridgeton if the latter ever was here) was largely removed, when the Cretaceous beds contributed more to the surface gravels than they did when the gravels northwest of Englishtown were deposited. This would suggest that the gravels northeast of Englishtown are somewhat younger than those to the northwest.

Knapp suggests that a plain sloping from 180 feet at Freehold to 140 feet at Englishtown and 120 feet at Jamesburg, was covered with Pensauken gravel, slightly to the southeast, and heavily to the northwest. In later erosion, the higher southeast region suffered most, and the gravels and most super-Cretaceous beds were removed, while to the northwest the surface beds were not so fully worn away. Later deposits northeast of Englishtown contained more Cretaceous material than the beds farther northwest, because the older gravels to the northwest were never removed so completely. This would make the gravels between Freehold and Englishtown somewhat younger than those of Gravel Hill. Analogous relations are found in the vicinity of New Sharon and elsewhere.

Northeast of Englishtown.—The possible Pensauken gravels here range from 110 feet (Clayton's Hill) near Englishtown, to nearly 200 feet near Wickatunk. To the west, the gravel caps small hills, and is 6 to 8 feet thick. It is, on the whole, poorly assorted, but with loam enough to make it fairly compact. Its base is irregular. In the larger patches, it runs down the spurs of the hills to levels below those of its base in the hilltops. In some of it, good sized cobbles occur, as at Gordons Corners, but they are not plentiful. The matrix of the gravel contains some greensand (now brown). In a pit at about 170 feet, 3 miles west-northwest of Marlboro, the composition of the gravel is as follows: 5 per cent. chert, 10 per cent. ironstone, and 80 per cent. quartz, about 3 per cent. being of cobble size. The sand with the gravel is about half glauconite. Other

areas west and southwest of Wickatunk repeat these phenomena with variations. What appears to be wind-blown sand, in many places glauconitic, covers the gravel in places. Correlations are uncertain.

A few areas of gravel at higher levels (190 to 200 feet) about Wickatunk, Knapp regards as perhaps Bridgeton, but the reasons for separating them from the Pensauken do not seem to be altogether convincing.

Disregarding some doubtful areas, there is a decline in the Pensauken surface from 170 feet 3 miles west of Wickatunk, to 120 feet near Englishtown, a decline in the direction of present drainage. The base of the gravels is marked by numerous irregularities of a trifling sort.

The character of these gravels indicates their local origin, but it varies much from point to point, quartz and ironstone alternating with each other as chief constituents. In general, the gravels at the lower levels are the better stratified.

Green surface loam abounds about the headwaters of Matchaponix Brook, from Freehold to Wickatunk. It is so persistent that some general explanation seems called for. In depth it ranges from 5 feet to 20 feet, and its constitution suggests the Red Bank formation as its source. Its distribution is consistent with an eolian rather than a fluvial origin.

Between Pine Brook and Barckleys Brook there is a series of gravel capped hills, declining from near 200 feet at the northeast (Robertsville) to 120 feet or so near Mounts Mills. In composition, the gravel ranges from quartz 2 : ironstone 1, to ironstone 3 : quartz 1. The gravel is, in part, well stratified, is mostly rather fine, and is most plentiful below the top of the formation.

The divide west of Wickatunk, extending to Robertsville and thence northwest between Deep Run and Barckleys Brook, separates two sets of gravel deposits, the one about Englishtown and northeast, and the other about Browntown and Matawan. The southern of these two regions includes the headwaters of Matchaponix Brook. In pre-Pensauken time this area seems to have had a surface sloping from the northeast, east, and southeast,

toward Englishtown. The area was somewhat amphitheatral in shape, with its rim at about 170 feet, and its low point at Englishtown, at about 110 feet. The material here which is regarded as possibly Pensauken contains notably more that was derived from the Cretaceous, than does the gravel at Gravel Hill and on the divide northwest of Englishtown. If early post-Pensauken drainage from the Matawan-Freehold region went to New Brunswick, and thence by way of Bound Brook through Kingston to Trenton, the course was very roundabout. If the present course of the Raritan to the ocean was developed after the gravel west of Englishtown was deposited, the change would have greatly facilitated erosion in the Englishtown region.

North of Deep Run.—The gravel remnants in this region which seem most confidently correlated with the Pensauken are those at 120 to 150 feet in the vicinity of Morristown, Morganville, and Browntown. The Cretaceous surface beneath the Pensauken at South Amboy and Old Bridge and Jamesburg, it will be remembered, has an elevation of about 90 feet. The gravels regarded as probably Pensauken about Morganville have an elevation of about 150, suggesting a Cretaceous surface sloping from 150 feet at Morganville to 90 feet at Old Bridge, just before the deposition of the Pensauken. No stream such as Matawan Creek or Cheesequake Creek seems to have been located along the strike of the Cretaceous beds at that time, and the creeks mentioned above seem to be of post-Pensauken origin.

Two miles northwest of Matawan, there is an elongate divide (Morristown-Jacksonville or Cheesequake) at an elevation of 130 to 150 feet, which has a gravel cap not less than 12 feet thick. Stratification is distinct, but assortment poor. Many pebbles stand on end, indicating rough or swift waters. Quartz and ironstone are both abundant, the latter partly in large slabs. The sand, which is largely beneath the gravel, has much glauconite. The gravel is very like the uppermost member of the Pensauken at South Amboy.

About the headwaters of Tennents Brook, especially on the divide between Browntown and Morganville, there are numerous hilltop gravel caps which are perhaps to be correlated with the

Pensauken. They are at altitudes ranging from 120 to 150 feet, and the depth of the gravel is known to range up to 8 feet. Higher hills east of Browntown, at $200\pm$ feet, do not have gravel caps, though surface pebbles suggest the former presence of a higher stratum carrying gravel. The gravel caps southeast of Browntown are all of southeastern material.

The gravel is similar, in all essential respects, to that between Englishtown and Freehold. It is not certain that it ever covered all the area within which the present remnants exist. As in most of the gravel caps of this region, the base is uneven. The floors of the pits, after the gravel has been removed, resemble the channels of small streams in some cases, the pockets of gravel being in more or less sinuous lines, comparable to scour holes in the beds of streams. In one of the gravel pits southwest of Morganville, the gravel after removal, was seen to have occupied a trough (channel) in what is now the crest of the elevation on which the gravel rests.

Locally, the ironstone makes up 95 per cent. of the gravel, though in most places it is subordinate to the quartz. Large pieces of both materials are of local occurrence. Two miles southwest of Morganville, the matrix of the gravel contains much marl, clearly from the Navesink marl.

Some of the beds of gravel here suggest displacement down slope. The original level of deposition seems to have been 130 to 150 feet. One fact leading to this inference is the greater depth of the gravel on the hilltops at these levels.

The surface on which the Pensauken was deposited northwest of Matawan, sloped toward the northwest, as if developed by drainage in that direction. Raritan Bay probably did not exist when this plain was developed. The valleys of Matawan and Cheesequake creeks have developed since Raritan Bay came into existence. They are clearly young creeks. They will, if not interfered with, send their heads farther and farther back into the country to the southwest.

The 150-foot plain, remnants of which appear west of Matawan, and thence to Freehold and Englishtown, would seem to be too high (now) for development at this level, with the drain-

age as it now is. But it is perhaps not too high if the drainage which developed it followed a sufficiently roundabout route when the plain was making. If, for example, the drainage of the Matchaponix went to Trenton by way of Bound Brook (city), and up the present Millstone, the headwaters of the Matchaponix, Deep Run, etc., might have developed a plain at a high level, possibly 150 feet. Furthermore, if the stream which these creeks joined crossed Rocky Hill 100 feet or less above sea level, this would have been the base controlling all levels above. A base at 70 feet at Kingston, would mean a fall of 80 feet from Englishtown, by way of Bound Brook, to Kingston, and this is probably not too high for the development of a plain at 150 feet at the former place.

OUTLYING AREAS EAST OF MATAWAN.

General Statement.—Between Matawan on the west and Atlantic Highlands on the east, there are numerous patches of gravel at levels which are rather low (50 feet to 90 feet) for Pensauken. Similar gravels occur south of Matawan and west of Cliffwood. These gravels are doubtless the counterpart of similar deposits south of the divide between Morganville and Middletown, but their correlation with the Pensauken is doubtful. They are perhaps the equivalent of the surface accumulations between Freehold and Englishtown, being somewhat younger than the Pensauken. Mr. Knapp is disposed to recognize a stage of deposition between the Pensauken and the Cape May, calling it *Walnford*, and would group the surface deposits between Matawan and Atlantic Highlands above the level of the Cape May formation under this name. Irrespective of the name, and of the probable existence of a stage of deposition between the Pensauken and the Cape May distinct enough to be separately recognized, it is probably true that the gravels mentioned above are intermediate in age between the Pensauken and the Cape May formations. Gravels a mile southwest of Cliffwood belong to the same category.

Knapp thinks the equivalent of the Jobstown flat can be traced, with interruptions, to Englishtown, and that its equivalent at

Matawan has an altitude of about 70 feet. The gravels, etc., on this ill-defined plain he would regard as post Pensauken, and probably pre-Cape May. If this is the case, there is no gravel equivalent to Pensauken in the area east of Matawan. The topography of this region is youthful, and the streams are eroding vigorously. Any Pensauken that once existed here may have been removed.

Topographic history.—It seems permissible to entertain the view that the major divide of the region, even in Pensauken time, extended from Matawan northeast to Long Island, and that from this divide there was a gentle slope toward Amboy. The absence of streams along the strike of the Cretaceous, in pre-Pensauken time, in such relations as those of Matawan and Cheesequake creeks, seems to imply the absence of a master stream along the lower course of the Raritan. This suggests the flow of that stream from Bound Brook via Kingston to the Delaware at Trenton.

If the lower Raritan below Bound Brook assumed its present course after the Pensauken epoch, the drainage relations in the direction of Raritan Bay were profoundly altered when the present course was established, while those to the southeast were not. This might have made great differences in the deposits of post-Pensauken time, on the two sides of the divide.

South of Matawan are hills 380 to 400 feet high with caps of Beacon Hill gravel, overlying Cohansey sand. The Cohansey and Beacon Hill formations once extended much farther north and northwest, probably reaching the present highlands (at an elevation of more than 400 feet) at the north. The Beacon Hill gravels may be taken as representing the starting point in the topographic development of the region.

Post-Beacon Hill drainage probably involved the flow of the antecedent of the Hudson across New Jersey. Adjacent to it, over a wide belt, the Beacon Hill and older beds down to the Cretaceous were removed, and a broad lowland was developed. To the southeast of the lowland, lay the main divide, perhaps from Long Island to Wickatunk, thence to Freehold, Clarksburg, Cream Ridge, Mt. Holly, Berlin, Glassboro, and Shiloh.

Adjacent to the plain of degradation developed by the main stream, there were minor plains along minor streams. The Woodstown Plain and its correlatives Knapp thinks traceable, by means of the parts remaining, nearly to Matawan. From this point east, the topography was developed by drainage to the northeast; all the rest of the way to Delaware Bay, the larger features of the topography near the broad valley between Amboy and Bordentown and Salem were developed by drainage which flowed to the northwest when the Pensauken gravels were deposited.

If major streams are made the basis of comparison, the broad plain from Amboy to Salem was controlled by a southwest flowing stream, while a narrow belt, northeast of a line from Wickatunk to Browntown, was controlled by drainage to the east.

After the main plain of degradation was developed, the drainage was changed, and Hudson River and Raritan River reached the ocean where Raritan Bay is now. Whether this change took place before or after the close of the Pensauken epoch is not now clear. After this change, present drainage was established, and the continuation of the old main divide east of Wickatunk was destroyed.

Description of deposits.—Within this area there is a series of gravel patches which Knapp regarded as Walnford (p. 147), which are of uncertain correlation. Several of them are elongate north and south, roughly parallel to the present streams. The westernmost is just south of Matawan, at an elevation ranging from 130 feet at the south to 60 feet at the north. At the south end only is the gravel well exposed. It contains much ironstone, some of which is in slabs a foot in diameter. Some of it is from the Red Bank formation of the Cretaceous system, and some from younger gravelly formations. The gravel and sand have a maximum thickness of at least 20 feet, are poorly stratified and poorly assorted, so far as the structure has been seen. With the gravel is more or less sand and marl from local terranes just to the south, exposed in the slopes north of Beacon Hill. Exposures in the west part of this area show the Cretaceous surface to be very irregular, and the gravel fills small gully-like

channels, not unlike those on the slopes of the hills to the south. After the gravels were deposited, drainage abandoned its old channels, and took new ones more easily eroded.

A little farther south there are small isolated hills at 140 feet and higher, capped with gravel which may well be regarded as Pensauken, and correlated with the gravel caps about Morganville, Morristown, Hightstown, etc.

Other minor patches of gravel between Matawan and Atlantic Highlands and below the level which seems appropriate for the Pensauken, need not be separately mentioned. There is one considerable area of such gravel between Hazlet and Matawan. It has an altitude of 140 feet at the south, and declines to 60 feet in a mile and a half. The material is similar to that farther west. South of Hazlet is another patch of similar material, with a good exposure a mile south of the station. It runs up to 170 feet at the south. Here again, the gravel fills an old valley. The gravel has a maximum depth of about 20 feet. The material is like that south of Matawan, except that there is more coarse gravel here, and fewer ironstone slabs. The constitution of the material points to the hills to the south as its source. The section is as follows:

- 3) 2 feet clay loam, generally with U-shaped pockets running down into 2), 2 feet more.
- 2) 6 feet coarse gravel, with matrix enough to make it compact. About 5 per cent. of the sand is glauconite. Ironstone fragments make up more than half the gravel. They are but little worn and some of them are slabs a foot or more across.
- 1) 4 to 6 feet of gravel and sand, less coarse, less compact than 2), with more quartz.

Southeast of Hazlet there is another patch of similar gravel, well exposed in pits. Quartz and ironstone are in the proportions of about 1 : 4. There are cobbles of quartz, and pieces of ironstone several inches across. This patch, like the one to the west, seems to be the site of an old shallow valley. In this case, a later valley cuts diagonally across the course of the stream which deposited the gravel.

West of Waycake Creek, a mile and a half south of east of Hazlet, there is a patch of gravel 10 to 12 feet thick at an altitude

of 110 to 70 feet. Ironstone, the major constituent, is partly from the Beacon Hill formation, and partly from the Cretaceous. The gravel is poorly cemented and poorly stratified. Knapp thinks this an accumulation of general fan type, at the bases of the hills to the south. The material is coarser at the south, and finer at the north, away from the hills. Along the west side of the creek are many patches of gravel ranging in altitude from 120 feet up stream, to 60 feet farther down. These gravels and sands are derived chiefly from Cretaceous beds up stream. They have a thickness of 20 feet in places, and are disposed in rude terraces. They represent former valley aggradation from an altitude of 120 feet down to $70 \pm$ feet.

Similar deposits occur east of Waycake Creek, in positions corresponding to those on the west. Little or no gravel is exposed, and the material does not constitute terraces, as on the west side of the stream. There are other similar gravels about New Monmouth, at levels of 60 feet and less.

There is a considerable bed of gravel at Hopping at an altitude of 60 feet, with its base at 40 feet. The gravel thickens northward and has a maximum depth of about 20 feet. It is well stratified and assorted. It is not clear that the material about Hopping is separable from the Cape May formation, but it does not form a terrace and nearly bare Cretaceous lies between it and the coast. Its topographic position seems to make it older than the Cape May, and younger than Pensauken.

There is much doubt as to the correlation of all these patches of gravel and sand (Walnford of Knapp) as well as of isolated patches which Knapp has classed as probably Cape May between Keyport and Red Bank, and in the area to the north of this line.

Between Hazlet and Keansburg, but nearer the latter place, are several gravel-capped hills at an elevation of about 85 to 100 feet. Exposures of 7 feet of gravel are seen, with base sloping northward. These patches are probably to be regarded as Pensauken. On some of the hills the material is very coarse, including boulders a foot in diameter. Miocene (Kirkwood) quartzite is recognized among them. Some of the ironstone, too, is in large pieces, and little rounded.

A mile northwest of New Monmouth are two other isolated hills having heights of 83 feet and 75 feet, with gravel caps similar to those farther west. These hilltop beds seem, from their topographic position, to be distinctly older than the gravels along Waycake Creek.

All those gravels regarded by Knapp as "Walnford" appear to have accumulated at the base of the marl highlands which extend from Morganville to Middletown. At the south the gravels start at 100 to 140 feet, and run down to 80 or less to the north. Many of them appear to be fan accumulations. The isolated hilltop gravels, while fairly harmonious in altitude, seem topographically distinct from the larger areas of gravel nearer the streams, and older. The disposition of the younger gravels suggests that the region was lower than now when they accumulated, else they would have gone down stream farther. If they did go down farther, their lower parts were destroyed later, or buried by the Cape May formation.

The Cape May terrace at $40 \pm$ feet at Atlantic Highlands, Cliffwood, and at other points to the northwest of Cliffwood, indicate a stand of land lower than the present. With this lower stand, there would have been deposition up stream. Are the "Walnford" deposits just referred to equivalents of the Cape May terraces about the coast? Their position might make this seem plausible, but their topography, and the erosion they have suffered, indicate their greater age.

In the Navesink Highlands, Cohansey sand is present, and possibly Beacon Hill gravel. The base of the Cohansey sand has an altitude of about 180 feet. Between 180 feet and 50 feet the Cretaceous has little cover, except for wash and talus.

THE PENSUKEN FORMATION ON THE ATLANTIC SLOPE.

In the basin of Swimming River.—The basin of Swimming River is surrounded by high lands, which rise above the level of Pensauken deposits on all sides but the east; but within the basin there are, at levels somewhat below the surrounding divides, various hills capped with gravels which are too high for the Cape

May formation, and some of them may be of Pensauken age. These patches of hilltop gravel are somewhat widely distributed.

North of Nut Swamp Brook, there is a series of these patches on the divide at altitudes of 90 to 140 feet. The lower patches occur down stream, the higher up stream, but all are within 2 miles of one another. The gravel caps are thin. Their range in altitude is great, and possibly all are not contemporaneous.

One to three miles west of Red Bank and south of Nut Swamp Branch there is a similar series of gravel-capped hills at elevations of 80 to 112 feet. The gravel caps are several feet (10 to 15 feet) thick, and the gravel is of quartz and ironstone, with loam enough to cause the material to pack well. Cobbles of Miocene quartzite are identifiable. All these beds of gravel decline toward the stream now, though it is not certain that they did originally. The material is, perhaps less well rounded and coarser up stream, but differences are not conspicuous. Pebbles of rock from the Red Bank formation, with abundant fossils, are readily identified.

Two isolated gravel-capped hills at 160 feet and 148 feet, 1 and $2\frac{1}{2}$ miles, respectively, east of Holmdel, line up with the gravel patches last mentioned. There is a series of gravel-capped hills east of Crawfords Brook, and east of Holmdel, declining from 165 feet a mile northeast of Holmdel, to 110 feet near Hop Brook, a distance of 3 miles. These might be interpreted as marking an old course of Crawfords Creek, when its channel was 80 feet higher than now.

A mile or less northwest of Holmdel are two hills with gravel at their tops at 160 and 178 feet, respectively. These are like those east of Crawfords Brook, and clearly different from the terraces along the stream here at 60 to 100 feet. The latter are regarded as of Cape May age.

Two and one-half miles southwest of Colts Neck is a hilltop bit of Bridgeton (?) at 180 feet (Taylors pit). This goes with the gravels on the hilltops 2 to 3 miles farther southwest, in the vicinity of Jerseyville.

South and southwest of Colts Neck, including the hills just noted, gravel occurs at various levels, mostly capping isolated

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hills. Most of these hills range from 150 feet in altitude to 130 but the extreme range including Taylors Hill is a little greater (180-120). These various fragmentary deposits might be regarded as of different ages, or, more probably (except on Taylors Hill), as stream deposits made at different levels at about the same time. They may be of Pensauken age, but this is not determinable definitely. Cases in point may be seen $1\frac{1}{2}$ miles southwest of Colts Neck (at 130 and 134 feet), and $1\frac{1}{2}$ miles south of Colts Neck, at 150 feet.

Below Colts Neck, to Scobeyville and beyond, there are considerable areas at 80 to 100 feet, which have a covering of rather recent material, of nondescript character, including some wind-blown sand of recent origin. Judged by its topographic position, this material is older than Cape May, and younger than the hill-top gravels mentioned above and correlated tentatively with the Pensauken.

It may be noted that Yellow Brook, Swimming River, and Shrewsbury River follow the strike of the Cretaceous beds, and their courses were probably assumed in Pleistocene time through adjustment.

Between the Swimming River Basin and Manasquan River.—The Manasquan valley is nearly at right angles to the valley of Swimming River. From its headwaters down to Squankum, the Manasquan has cut through all the overlying beds into the Cretaceous. Below Squankum it flows over beds younger than the Cretaceous. The dip of the beds is therefore greater than the fall of the stream.

Knapp thinks Willow Brook, now tributary to Swimming River, once flowed southeast, parallel to the Manasquan, reaching the sea somewhere in the vicinity of Asbury Park. If this was the case, the Manasquan has held its course, but Willow Brook has been diverted, and the former course of its lower portion is not now evident. The adjustment perhaps did not take place till the streams had cut down to the Cretaceous. Terraces of Pleistocene material are difficult to recognize in the valley of the Manasquan, because the Pleistocene deposits, derived from the Tertiary formations, are very like the latter.

About the headwaters of the Manasquan, down to Fairfield, determinations are unsatisfactory. Exposures are few and poor, but there is a rather prevalent surfacing of gravel and sand. Two miles west of Farmingdale, in the east bank of the tributary, there is 10 to 15 feet of gravel, regarded as Cape May. Along the Manasquan there are terraces which appear to be without much Pleistocene cover.

Three miles or so east of Freehold are some hills at about 200+ feet which are without gravel other than that which goes with the pre-Pleistocene of the region. Near them are other hills at elevations of 140 to 150 feet with some gravel, which appears to go with the gravel of the hills between Englishtown and Wickatunk. A half mile northwest of Jerseyville, at 160 feet, there is 4 feet of gravel over Kirkwood sand. This and other remnants at similar levels seem to mark a level of accumulation at one time, perhaps during the Pensauken epoch.

Other similar hilltop gravels occur a mile or so south of Howells Station (at 145 to 150 feet), and south of Fairfield Station (at 140+ feet).

About Jerseyville gravels occur at various levels between 160 and 170 feet. Their materials were derived from the Cretaceous, Kirkwood, Cohansey, and Beacon Hill formations, and but little from the Cretaceous. The remnants are on ridges and hilltops, and are absent from the hills at 200 feet and above. They appear to agree in elevation more closely with the gravel on Taylor's Hill than with the remnants south of Fairfield, and are therefore tentatively regarded as Bridgeton, although in some respects they are like the Pensauken.

There are remnants of possible Pensauken, $1\frac{3}{4}$ miles and less, northwest of Farmingdale, at 110-130 feet. The gravel, like most of that of the region, is quartz, chert, and ironstone. But for the latter, it is very like the Beacon Hill gravel.

North of Shark River there are hilltop caps of gravel, small and rather high. West of Asbury Park and south of Wayside (Centerville) they occur at elevations of 160 to 200 feet. The higher, smaller patches are farther from the streams; the lower, larger ones nearer to them. Some of the highest are regarded as Bridgeton, but the lower areas may be Pensauken. At

Green Grove and farther north are much larger areas at elevations ranging from 130 feet down to 80 feet southeast of Hamilton (Shark River village). West of Green Grove is a long gravel patch, poorly exposed and indefinite, at 130 to 140 feet. These gravels and sands at 120 to 130 feet, and at somewhat lower levels near the sea, are perhaps Pensauken.

The patches of gravel between Manasquan Valley and Shark River are at various levels and are difficult of interpretation. Back of Manasquan, there are gravels at 50 to 65 feet which may be Pensauken. Similar areas occur farther north at Baileys Corner, New Bedford, Glendola (Hopeville), and vicinity, and reach a maximum elevation of a little more than 100 feet. These gravels are much alike, are in similar topographic positions, and are doubtless one in origin. They are unquestionably older than the Cape May formation, and apparently harmonize with those north of Shark River regarded as Pensauken.

One to two miles west of Manasquan and Brielle, there is an area of gravel (base 90 to 100 feet, surface 100 to 110 feet) which is distinctly older than that at the lower level (50 to 65 feet) a mile to the northeast. The gravel of this higher area is to be correlated with that on the divide just east of Allenwood, with that a mile and more northeast of Allaire, and with that in several small areas northwest of Glendola (Hopeville). The gravels in these several places range up to 150 feet or so. They seem to be rather low for Bridgeton, and too high for Pensauken, but it is more probable that they belong with the former than with the latter.

Their correlation with the small gravel caps of the higher isolated hills south and west of Wayside seems on the whole most satisfactory, particularly since in both regions these areas cap divides or isolated hills, and in both there are two series of gravel deposits at lower levels. It follows from the above that the large gravel areas northwest of Manasquan, at Baileys Corner, near New Bedford, at Wall, and Glendola, are correlated with the areas at Hamilton and the larger areas south and west of Green Grove. Probably the gravel at Shark River station and near Shafto's Corners belongs here also. All these are

regarded as probably Pensauken. It is recognized that other correlations might be made, and that in some of its details the one suggested may be erroneous. Variations in elevation are to be expected in deposits of the same age laid down in adjoining drainage basins, even at equal distances from the sea.

South of Manasquan River.—From the preceding pages, it is clear that the correlation of any gravels and sands on the Atlantic slope with the Pensauken of the Raritan Bay-Trenton-Salem belt, becomes increasingly difficult as distance from that belt increases. The correlations of the Quaternary deposits in the upper basins of the streams flowing northward and westward to the Raritan and the Delaware, are somewhat uncertain at many points. Those in the basin of Swimming River are made with large reservations, and in the basin of Manasquan River there is still more doubt; so much, indeed, as to make the attempt at detailed correlation futile. Gravels and sands of Pensauken age doubtless exist south of the Manasquan River, as north of it, but their differentiation from the Bridgeton and other post-Miocene formations becomes less and less satisfactory toward the southeast.

The general fact, as now understood, seems to be that the surface of the Beacon Hill formation, in post-Beacon Hill time, declined steadily to the southeast, at an angle which corresponded roughly with the dip of the older Coastal Plain beds. During the period of erosion which followed, the valleys cut in the surface of the Beacon Hill formation were not very deep, and probably not very wide, as the porous nature of the Beacon Hill and Cohansey formations did not favor great surface run-off. Southeast of a line drawn from Bridgeton to Red Bank, it is doubtful if the Beacon Hill and Cohansey formations were ever cut through more than locally, by the streams.

Later, in the period of Bridgeton deposition, the valleys in the Beacon Hill and Cohansey formations were probably aggraded, but with material derived from these formations, and at the northwest, from older formations as well. The Bridgeton deposits therefore which are believed to be on the southeastern slope are not very distinct, lithologically or topographically, from the older beds on which they rest. The principal difference in

constitution should be the presence in the younger formation of bits of conglomerate and sandstone from the former, showing cementation of the older formation before the deposition of the younger. But cementation of the older formations here is not prevalent, and the absence of good exposures in most of the region does not favor the application of what seems to be, theoretically, a good criterion.

During the interval of erosion which followed the deposition of the Bridgeton beds, degradation followed the same general course as before. The extent of the erosion at this time has not been determined, and is not readily determinable. It may be that a large part of the ill-defined Bridgeton of this region was removed at this time.

Then followed the epoch of Pensauken deposition, when the deposits made in the valleys were the same in kind as those of the Bridgeton epoch. In case the post-Bridgeton streams had not cut through the Bridgeton deposits, the Pensauken deposits would hardly be distinguishable from the older sediments, unless on topographic grounds, and these grounds are wanting. It is not known how high the land stood relative to sea level in either epoch. No shore lines are to be found, and no fossils are available.

Furthermore much of the region is but sparsely populated, and much of it is in timber. Exposures and sections are therefore few, and over great areas, altogether wanting, and there is only the surface sand and gravel on which to base judgment. Topographic features are feebly developed, and topography therefore helps little except at low levels.

Gravels which are either Bridgeton or Pensauken or both, can be located at many points, but a complete list of such places would not be very instructive. Some of the larger or more significant are mentioned below: (1) East of Toms River (stream) between the cities of Lakewood and Toms River, at elevations of 150 feet at the north to 30 at the south, (2) on the divide in direct line between Toms River (city) and Lakehurst, from 100 to 40 feet, (3) about Barnegat Park, from 70 to 40 feet, (4) at Whittings at many points on uplands south

of Whittings and north of Mullica River, from 200 to 100 feet, (5) considerable areas on the divide about the basin of Absecon Creek, at altitudes ranging from 80 feet to 50 feet, (6) on the upland between Mullica and Egg Harbor Rivers, from 50 feet near the coast up to 90 or so inland, (7) between Great Egg Harbor River and Maurice River, especially north of Manumuskin, at 110 feet or so at the north to 70 feet at the south, and (8) on the uplands between Maurice River and Cohansey Creek, especially south of Vineland and Bridgeton. There may be much Pensauken undifferentiated from the Bridgeton in the great area bounded roughly by Glassboro, Berlin, Atco, Landisville, Vineland, Bridgeton, Roadstown, and Aldine.

CHAPTER IV.

THE CAPE MAY FORMATION.

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General Description.

POST-PENSAUKEN EROSION.

After the deposition of the Pensauken formation, a long period ensued when conditions favored erosion where deposition had just taken place. During this epoch of erosion the Pensauken formation was removed from large areas, and dissected to about its present condition in others. In the great lowland which extended from Raritan Bay to Salem by way of Trenton and Bordentown, the formation was greatly reduced in many places where it was not altogether removed. As already indicated, it is not certain that its original thickness remains at any point, though it probably does in some places between South Amboy and Delaware River. From Bordentown to Salem, its remnants are more meager.

This long epoch of erosion preceded the last glacial epoch. The details of its history are recorded chiefly in the fragmentary condition of the formation last deposited. It would appear that

the land stood somewhat higher than now, relative to sea level, during some part of this interval, for in some places valleys were cut down a little below sea level. The great duration of the period is indicated by the great width of the valleys cut by larger streams in and through the Pensauken formation.

DEPOSITION OF THE CAPE MAY GRAVEL.

Date.—After this period of erosion there followed an epoch when deposition again became important. Deposits were made both in the valleys and on the low lands about the coast up to levels of 40 or 50 feet at least. The date of this epoch of deposition can be fixed more definitely than that of some of the preceding events, for it was coincident with the last glacial epoch, when a continental ice sheet covered the northern part of the State, its edge occupying a sinuous line from Perth Amboy to Belvidere, passing through or near Plainfield, Summit, Madison, Morristown, Denville, Dover, Budds Lake, Townsbury, and Buttzville. At this time, a large volume of ice water flowed down through the Delaware Valley, and carried glacial debris in abundance to Trenton, and in lesser amount to Camden and possibly below. It is the association of this glacially derived material in the Delaware Valley with materials not so derived in the lower Delaware, that fixes the age of this last important stage of deposition in southern New Jersey; for in the lower Delaware, the contemporaneity of the deposits made by glacial waters issuing from the ice at Belvidere, with deposits about the coast at levels up to 40 or 50 feet, is clear.

The deposits of this epoch affected not only the coastal lands and the low lands of the main valleys, but they were made in essentially all the valleys of the southern part of the State, even those parts which were far from the coast and at elevations far above sea level.

Cause.—During this epoch of deposition, the southern part of the State seems to have stood a few feet (30 to 50) lower than now. This was doubtless one cause of deposition, but not the only one. If all parts of a stream's basin were lowered by the

same amount, the flow of water would not be affected except in the part drowned. But in this epoch, deposition took place in those parts of the valleys which were well above sea level, so that something besides a lower stand of land was involved.

If with the lower stand of land, the upper parts of streams were depressed more than the lower parts, the flow of water would be more sluggish throughout, and deposition favored. Again, a change of climate might have been adequate, in itself, to cause deposition,—especially such a change as went with the glacial epoch. The cold which glaciation implies would have reduced appreciably the vegetation of the region bordering the ice, and no part of the area here under consideration was far from its edge. The reduction of vegetation would have favored erosion outside the channels of the streams, especially in a region such as southern New Jersey, where the surface formations are chiefly gravel, sand, marl, and clay. Even if precipitation was not increased, more of it doubtless fell as snow, and the melting of the snow at the season when the ground is least protected by vegetation, would have favored erosion. In this way it is believed that much detritus was gathered from the slopes and carried down to the valleys where deposition took place. If at the same time the lower ends of the valleys were depressed, their lower parts were silted up, the aggradation would have checked drainage above, and so have favored deposition above the lower ends of the valleys. This might have been effective far up the valleys of streams with low gradients, like those of southern New Jersey.

DISTRIBUTION.

In valleys.—In keeping with this conception of the deposits of this time, the sands and gravels which represent it are found at low levels about the coast and in the lower ends of the valleys, and they extend far up the valleys to elevations of 140 or 150 feet along streams which have their source in the higher parts of the Coastal Plain. The formation is named from the peninsula or cape at the southern point of the State, for all the material of Cape May, so far as exposed, belongs to this epoch.

Along the coast.—According to the conception outlined, the Cape May formation forms a nearly continuous border about the southern part of the State, from Raritan Bay to Trenton, and in addition, extends up the valleys of nearly all streams which come down to this border. How much of the formation about the coast is marine, and how much subaërial (fluvial, pluvial, etc.), is not determined. If the sea level stood 30 to 50 feet higher than now, it does not appear to have stood there, or at any other one level long, for sea cliffs of distinct and unequivocal character are essentially wanting. On the other hand, the Cape May deposits about the coast are in places distinctly terraciform, and consistent with the conception of marine origin. Distinct sea cliffs at their inland border are, however, generally wanting. In the coastal phase of the formation, the materials are not so mixed as in its valley phase. In the former situation, the sand and gravel in places at least resemble shore deposits, rather than deposits by streams and rains.

Topography.—Barring interruptions by subsequent erosion, the valley deposits, now in the form of terraces, are continuous with the coastal deposits, and the contemporaneity of the two is not open to question. At the coast, the level of the valley terraces is the same as that of the coastal phase of the formation; but they rise up stream at gradients which vary somewhat from valley to valley, being less in the lower lands and greater in the higher. In other words, the gradient of the terraces is in keeping, in a general way, with the present gradients of the streams.

It is clear, therefore, that the upper limit of the formation is not defined by a contour line. About the coast it is mostly below 50 feet; but in some of the valleys it runs up to heights three times as great, and in a few places even higher. The terraces are well defined in some places and ill defined in others. In some places they are composed wholly of Cape May material, while in others, material of this age covers, as with a veneer, a foundation of older material.

CONSTITUTION.

Comparison with the Pensauken.—Where the Cape May terraces rise up stream to the Pensauken level, as is the case in some places, it is difficult to distinguish the two formations on the basis of topography; but if good sections are available, the distinction between the two commonly is not difficult on the basis of composition and texture. The material of the younger formation is less compact and less coated with iron rust, and betrays in various ways not easily designated its lesser age. There is a marked absence of soft decomposed material, such as is often present in the older gravel, but which would naturally have been ground up in the reworking of the material in Cape May time. The material of the terraces in the valleys is unlike that of the coast in being much more mixed, much less well assorted, and much less clean. It covers broader areas in the larger valleys, and narrower areas in the smaller ones.

Fossils.—Fossils are unknown in the Cape May deposits at most points, but near Buckshutem, marine fossils are found up to elevations of 10 feet or so above tide. The deposits here in Delaware Bay are more clayey than at most places on the eastern coast, and so are better adapted to the preservation of fossils.

Local Details.

TRENTON AND EASTWARD.

Since the connection of the Cape May formation with the glacial gravel at the north is by way of the Delaware Valley, the details of the formation, so far as given here, will begin with those near Trenton, where the considerable bodies of gravel and sand of distinctly glacial origin reach their southern limit.

Vicinity of Trenton.—At Trenton and just south of it, the glacial gravels make or cover a considerable plain which has an elevation of about 60 feet, being limited at the east by that contour. The glacial-gravel plain extends half way to Bordentown, but, on the New Jersey side of the river, ends abruptly west of

White Horse and north of Crosswicks Creek. Here the Delaware swings over to the east side of its valley, and the real continuation of the Trenton gravel plain is west of the river. At Florence, the Delaware again leaves what was its eastern border in the Cape May epoch, and glacial gravel reappears there on the New Jersey side of the river.

From Trenton (Chambersburg), the formation extends northeastward in a broad belt up to Bakers Basin. Farther northeast it is continued in a narrower belt over the low divide between Shipetaukin Creek and Stony Brook, and down the valley of the latter to its junction with the Millstone River. The formation also extends up the valley of Duck Pond Run from Port Mercer, and over the low divide to the Millstone at Princeton Junction, and thence down the valley of the Millstone to the mouth of Stony Brook. Meager and dissevered remnants of the formation are also found in the valley of the Millstone from this point to its junction with the Raritan.

At Trenton, and thence to Bakers Basin, the formation is largely of gravel brought down by the Delaware from the moraine at Belvidere during the last glacial epoch. Glacial gravel is found also from Bakers Basin to the Millstone, as well as at various points along the Millstone to the Raritan. Since these gravels are a little higher at the north (70 feet at East Millstone), it is inferred that the drainage which brought them in flowed from the Raritan to the Delaware, and the composition of the gravels points to the same conclusion. It is inferred therefore that, temporarily at least, during the last glacial epoch, drainage from the Raritan came up the Millstone to Stony Brook, up the valley of that stream, and over the low divide to Assanpink Creek, and thence to the Delaware at or near Trenton. The meager remnants of glacial gravel in the valley of the Millstone may mean that glacial drainage did not follow this course long, or in large quantity.

Aside from the chief belt of the formation in the valley of Assanpink Creek, it appears in most of the minor valleys of the Raritan Bay-Trenton lowland, as (1) along Pond Run; (2) along Miry Run for several miles, rising from 60 feet or so near

the Assanpink to nearly 90 feet northeast of Newtown; (3) along the upper Assanpink, rising from 60 feet near Lawrence Station to 100 feet above New Sharon, 10 miles or so up stream; (4) along Bear Brook, rising from 60 feet near Princeton Junction to 100 feet a mile and a half west of Hightstown; (5) along the Millstone above Princeton Junction, rising to more than 100 feet above Red Tavern; and (6) along Cranbury Brook, rising to 110 feet near its source. In all these six valleys the materials of the formation were derived from the older formations of the respective drainage basins. In composition, therefore, the Cape May formation of these valleys is essentially unlike that at Trenton, in that it contains no glacial or other northern material. In general the formation in the minor valleys is not disposed in the form of distinct terraces, though it takes on a terrace-like form here and there. Rather does it border the streams, grading from the flood plains below to a fairly definite level on the slope above, a level which rises up stream. The upper limit of the formation at any point in the valley is not sharp in all cases. Especially where exposures are poor, gravel and sand brought down and deposited by the streams cannot be sharply separated in all places from slope wash derived from the Pensauken formation.

The close association of the formation with the streams, its rise up the valleys, and the fact that the materials were clearly derived from the basins in which they occur, seem to leave no doubt as to its fluvial origin.

Chambersburg (Trenton).—Sand and gravel pits in the vicinity of that part of Trenton known as Chambersburg show a mingling of glacial gravels and sand, with sand and gravel brought in from the east and derived from Cretaceous and younger formations. Glacial gravel and sand, and gravel and sand from the Miocene about the headwaters of Doctors Creek, are readily recognized. In some places the glacial gravels and those from the east are intimately mingled. In other places they are so related as to indicate that the amount coming in from the one source was sometimes far greater than that coming in from the other.

Pond Run.—The Cape May formation has no distinct development in the basin of this creek, above the Trenton plain; but thin deposits perhaps to be correlated with it are found over the lowland nearly to the sources of the stream. They do not constitute distinct terraces, but line the lower parts of the basin up to the Pensauken level. The most that can be said of the surface deposit over this lowland is that it is post-Pensauken, and a large part of it is no doubt Cape May.

Miry Run.—Cape May gravels and sands exist along this valley up to Newtown, but the volume of the formation is slight. Its materials are from the Cretaceous and Pensauken formations, the only formations accessible to the stream and its tributaries. The material is but a few feet above the stream, much of it in low terraces 5 to 15 feet above the bottom of the valley. In constitution it is different enough from the Pensauken (or Cretaceous) above, so that the limits of the deposits are fairly well defined in the soil.

On the uplands, especially north of Miry Run, there is some loam (and sand) which appears to be wind blown, and to contain material derived from the Trenton (glacial) gravels and sands. The same sorts of loam and sand are seen interruptedly from Miry Run to White Horse.

Assanpink Valley.—Up to Bakers Basin and Lawrence Station this creek flows through the low plain (60 feet) covered by glacial gravel; but above Lawrence Station its valley is comparable to the valleys of other creeks of the region. The stream is a long one, heading back in the Clarksburg hills; but above Lawrence Station, its valley is relatively narrow.

The Cape May deposits of this valley are nearly continuous, on the north bank of the stream, up to New Sharon, but have little development on the south side, though there is a well-defined terrace at Edinburgh, at an elevation of 80 to 90 feet, on the left bank. In the vicinity of Lawrence Station, the material is mostly sand; but farther up there is more gravel. Above Edinburgh, much of the material is in terraces, 10 to 25 feet above the stream. The terraces are for the most part ill defined, and their constitution varies much from point to point in the valley. In

the vicinity of New Sharon, there is some wind-blown sand, perhaps comparable to that along some of the creeks farther south (as Crosswicks and Doctors). Where eolian sand mantles both the Cape May and the Pensauken formations, it obscures the distinction between them, where exposures are absent.

The sand-loam over the uplands here is conspicuous in some places, especially between Assanpink Creek and Miry Run. Where it is well developed, there is, in numerous places, an undulatory topography, including some undrained depressions. This is most common about the heads of the minor tributaries. The loam here is of the same general type as that at many other places in the vicinity. It is perhaps most obvious and best differentiated from its base where the underlying formation is red shale, as at Wilburtha and Washingtons Crossing on the Delaware, or along the valley of Shabacunk Creek, between Trenton and Lawrenceville. The same type of loam recurs on the east side of the Millstone in the vicinity of East Millstone, Griggstown, Kingston, and in the vicinity of Penns Neck. The loam is, on the whole, quite unlike that along the lower Delaware and its tributaries. That along Assanpink Creek and the Delaware above, is finer and more uniform than the silts and sands of eolian origin farther south, and contains much less material which looks as if derived from the glacial valley train. On the other hand, the loam above the level of the Trenton gravel is not unlike the loam which covers the Trenton gravels and sands.

Bear Swamp.—In Bear Swamp, material of fluvio-glacial origin is less conspicuous than in other near-by areas at the same level. It is present, however, and material of similar origin has been recognized in a sand pit three-fourths of a mile southwest of Princeton Junction. These facts, taken in connection with other phenomena of the region, indicate that glacial waters flowed on all sides of the Penns Neck tract, which rises above the Cape May level. The materials in the Bear Swamp valley are finer than those in the valley of Stony Brook to the north, suggesting that the main drainage was through what is now Stony Brook valley. With Stony Brook valley filled to 60 feet with glacial gravel from the north, Millstone River would

have flowed through Bear Swamp; but the valleys of Stony Brook and Bear Swamp are so nearly at the same level that the waters flowing about the Penns Neck upland could have been diverted easily from the one route to the other.

Bear Brook.—The Cape May formation appears all along the northeast side of this short valley, well toward its source. Locally it assumes the form of definite terraces, but more commonly it is not so disposed. Its surface differs from that of the upland chiefly in being more sandy. The material consists of gravel, sand, and loam.

The upper Millstone (above Princeton Junction).—This river heads east of the Clarksburg hills, and traverses a greater range of formations than other streams of the region, except Assanpink Creek. In general it may be said that the Cape May formation of this valley consists of a thin body of material mostly on the right bank of the stream, from Red Tavern to Princeton Junction. In many places it is disposed as a distinct terrace 10 to 20 feet above the stream, composed of the loose sand and gravel characteristic of the formation. At other places the terrace form is wanting, and there is at the surface no sharp distinction between the distinctive Cape May material below, and older formations above. The indefiniteness is partly the result of the loam mantle. The material in most of the valley seems to have come largely from formations at higher levels in the vicinity, while little seems to have come down from the head of the valley. The conspicuous thing about the formation here is its definite relation to the stream. Above it, the slopes are mantled with loam which appears to stand in no definite relation to the underlying formation. Where the loam is well developed, there are undrained depressions, usually small and shallow.

In the upper reaches of the valley, in the vicinity of Bergen Mills and below, there is much sand which resembles that along Crosswicks and Doctor creeks, probably eolian in its present position. In this vicinity the valleys of Cranbury Brook and Millstone River head in the same flat, and a shallow ditch would divert one stream into the valley of the other.

In the region about the headwaters of Cranbury Brook, both branches of the Millstone, and the Assanpink (from Gravel Hill on the northeast nearly to New Sharon on the southwest), there is much material which is not easily classified. Much of it probably is of Cape May age, or of this age approximately. It is material deposited after the long erosion which followed the deposition of the Pensauken, but is not so definitely connected with the streams as the Cape May formation commonly is. This may be because it is in the region where the valleys are less well defined, and where the deposits are of the piedmont type, rather than of the distinct valley type. This material was mapped by Mr. Knapp as "undifferentiated," but it might be included with the Cape May, if that term be made to cover post-Pensauken deposits in general.

Cranbury Brook.—The Cape May formation of this valley is disposed as in the valley of the upper Millstone, being confined chiefly to the right bank of the stream. It is fairly distinct up nearly to the head of the valley. It covers the low slopes, and constitutes low benches 10 to 20 feet above the stream. The soil over the formation in this valley, as in the Millstone, is much more sandy than that of the upland. The distinction is recognized in the region by differences of farm crops.

The lower Millstone.—At Princeton Junction, the three main branches of the Millstone, Bear Brook, the upper Millstone, and Cranbury Brook, come together. There is much gravel and sand over the headlands between the lower ends of the streams. Its depth is unknown, but it goes down to and perhaps below the levels of the permanent streams. The upper surface of the formation reaches a maximum altitude of about 70 feet.

Over the gravel and associated sand there is some sand and loam, which covers higher lands as well. The loam varies from sandy to clayey. Cuts have revealed the loam as a definite mantle 8 to 10 feet thick in some places, and clearly distinct from its base. Where the loam is sandy, it is eolian, and perhaps all of it had this origin.

Just south of Kingston, there is a bit of the Cape May formation in the valley of the Millstone, east of the canal. Its upper

limit is at about 70 feet. The material consists of a mixture of glacial gravels with material derived from the Pensauken. There is here a considerable amount of glacial material similar to that at Bakers Basin at an elevation of 60 feet. Traces of the same sort of material are found in the valley above Kingston, at corresponding levels, but it is not present in quantity.

A mile north of Griggstown, on the east side of the Millstone, fluvio-glacial gravel is found in relations similar to those west of Penns Neck, opposite Princeton. The remnants are seen along the ravines which lead down to the canal. They suggest that the valley of the Millstone was once filled with glacial gravel up to the 60- to 70-foot level, most of which has since been removed. Some of the remnants appear as miniature ridges, 2 to 4 rods across, with probably 3 to 6 feet of gravel of distinctly glacial type. Between Rocky Hill and Griggstown, the merest traces of similar gravel—really little more than scattering pebbles—are found at various points and at harmonious levels.

North of East Millstone village, the same material is more abundant, and appears as definite terraces, as in the vicinity of Weston and Hillsboro. At East Millstone there is a good deal of sand at 60 to 100 feet, similar to that on the shale slope above Bakers Basin. It is probably eolian.

The disposition of this glacially derived gravel in the valley of the Millstone does not show decisively how the drainage flowed. The gravel is a bit higher at East Millstone than farther south in the vicinity of Princeton Junction and Trenton; but it is also a little higher at East Millstone than at Weston, farther north. The constitution of the gravel, while not very decisive, suggests drainage to the south, for certain sorts of pebbles characteristic of the gravel of the Delaware are not found at Princeton Junction and north.

Crosswicks Creek and Doctors Creek.—The formation has considerable development about Yardville at the lower end of Crosswicks Creek, especially below Crosswicks (village). Thence it extends up Back Creek nearly to Newtown, up Doctors Creek beyond Imlaystown, and up Crosswicks Creek to Walnford and beyond. It rises from an altitude of 60 feet near the Delaware, to 120 feet at Imlaystown some 15 miles above, an average

slope of about 4 feet per mile. The gradient increases toward the heads of the valleys.

At Yardville, the formation is 10 to 30 feet deep, and its surface elevation is about 60 feet. Back from the stream, the heavy beds of sand and gravel thin out, and the Cretaceous surface beneath rises above this level. The materials here clearly were deposited by Doctors and Crosswicks creeks. The plain at 60 feet here is the topographic equivalent of the 60-foot plain at Trenton, and their contemporaneity is not open to question. That they are not continuous is an accident of later erosion. The constitution of the formation at Yardville shows that glacial materials brought down by the Delaware did not go up the valley of Crosswicks Creek. The general absence of silt and clay in the formation at Yardville and above indicates that tributary streams were able to aggrade their valleys about as rapidly as the Delaware; otherwise the side valleys would have been ponded, and deposits of silt or clay would have been made. It is true that thin beds of clay appear, here and there, in the Cape May formation of this and other valleys, but it is exceptional. It is perhaps more common farther south than in the latitude of Crosswicks Creek, and is sufficient to suggest the local and temporary ponding of different streams.

Near the Delaware the materials are gravel, sand and loam. The loam is largely at the top, and glauconitic; locally it is so heavy as to be used for brick. The sand, which is interstratified with the gravel, is also glauconitic, more conspicuously so than the loam. The gravel is mostly fine, clearly from the fine gravel (pebbles the size of peas) of the Miocene, in the vicinity of Stone Tavern. Back from the streams, sand and loam predominate greatly over the coarser material. South of the creek below Yardville, the formation is covered with glauconitic sand and loam of eolian origin. Good exposures are seen southeast of Yardville in the bank of Crosswicks Creek, on the road to Crosswicks, and along the Allentown road. Locally there is enough dune sand to modify the surface notably. It was derived largely from the Cape May formation.

In the valley of Back Creek, the formation rises but little above its level at Yardville, and is ill defined.

Up to Crosswicks (village) the valleys of Doctors and Crosswicks creeks are close together, and the divide between them is low, and covered with the Cape May gravels and sands, which seem to have been deposited by Crosswicks, rather than by Doctors Creek. Both streams have cut through the formation, revealing the Cretaceous below. Along both creeks, the Cape May formation is developed chiefly on the right bank of the stream, and where distinctly developed, it appears in the form of terraces. The terraces are not persistent, and not always distinct, for their upland limit is ill defined in many places, because the slopes above are low and gentle, leaving the upland edge of the terrace poorly marked topographically. Along both creeks there is eolian sand on the left banks, at the levels where the Cape May should be, though the sand occurs up to levels somewhat higher than those appropriate to the Cape May formation. There is such sand on the left bank of Doctors Creek above Yardville, and on the left banks of both creeks, farther up. Along both creeks the left bank is slightly higher than the right, the excess being due to eolian deposits. In the upper parts of both valleys the formation is less well developed. Instead of appearing in the form of flat-topped terraces, it lines the valley bottoms. Its slopes toward the stream are in part at least due to erosion since the gravel and sand were deposited.

On Doctors Creek, a mile and a half northeast of Crosswicks village, there is a terrace of sand and fine gravel at an elevation of 60 feet. Up Doctors Creek, the formation rises to 90 feet at Allentown, and more rapidly above, up to a point a mile or more above Imlaystown. Three-fourths of a mile west of Allentown, there is a well-defined terrace at 70 to 80 feet, which appears to represent the height of the filling in the Cape May epoch. On the south side of the creek there are higher sands (90 to 95 feet) which are probably eolian, which seem to go with the Cape May formation, or to be subsequent to it.

At Allentown there is some 20 feet of Cape May material, more than at any point below down to Yardville, and more than at

any point above. There are well-defined terraces at points above, with 10 feet of sand and gravel, but to the eastward the formation becomes less and less well defined topographically. On the south side of the stream, the wind-developed ridges of sand persist nearly to Imlaystown, and reach a maximum altitude of more than 120 feet.

Just above Crosswicks (village) the Cape May formation is disposed as a terrace in the right bank of the creek. Its elevation is 60 feet, and its surface of loam; but exposures and data from wells show that the terrace is of gravel chiefly, alternating with minor beds of sand. In the gravel, quartz and chert are abundant, sandstone and quartzite common, and water-worn pieces of ironstone common to abundant. In other words the materials came from the Cretaceous, the Miocene, and the Pensauken formations.

In the valley of Crosswicks Creek the terraces are fairly definite more than a mile east of the village. Farther up they are feebly developed at most places, though distinct on the east side of the stream above Walnford. The formation rises to 90 feet opposite Walnford, above which point it has little certain development.

The terraces along both creeks have, as a rule, surfaces of loam, and this extends up above the terraces on both sides of both valleys, and thus constitutes a veneer over terraces and uplands alike. It is clearly not of residual origin. The idea has been entertained that it constituted a formation to be separately recognized, possibly the result of a submergence; but it seems on the whole more probable that it is eolian. This veneer of surface loam helps to conceal the from-stream limits of the Cape May formation.

At Walnford and for 3 miles below, there is a somewhat ridge-like deposit of glauconitic sand on the left side of the creek. The feeble ridge is somewhat interrupted by tributary valleys, but otherwise persistent. Just west of Walnford, the sand is highly glauconitic, but the proportion of glauconite diminishes toward the Delaware. The sand of this ridge is partially eolian, and locally a very subdued type of dune topo-

graphy is to be seen. Above Walnford the same sort of sand, probably eolian, occurs on the east side of the creek above New Egypt, up to the point where the creek turns west; but here the sand, with a disposition to become slightly ridgelike, is much interrupted by side streams. The same sort of a sand ridge appears on the left bank of Doctors Creek. It is feebly developed just above Yardville, and better from a point a mile below Allentown up to within a mile or so of Imlaystown. Along this creek the sand is much less glauconitic than along Crosswicks Creek.

The phenomena of these valleys are common ones in the region, a low ridge of sand on the left banks of the streams, and a terrace on the right banks, at a somewhat lower level.

Lahaway Creek.—Along Lahaway Creek, between Horners-town and Prospertown, there are interrupted and feeble terraces rising to 140 feet at the latter place. The terrace material ranges up to 20 feet in thickness, and is of sand and gravel, the latter more abundant near the stream. These terraces are not satisfactorily correlated. They may be of almost any age from late Pensauken to Cape May.

Along Crosswicks and Doctors creeks, there is no hesitation in correlating all the distinct terraces of gravel and sand, at an elevation of 60 feet near the lower ends of the valleys, and up to 80 feet at Walnford and 120 at Imlaystown, with the Cape May formation, and in regarding them as the time equivalents of the gravels of late glacial age at Trenton. The feeble ridges of sand on the left banks are probably mostly eolian, and of similar age.

IN THE LOWER DELAWARE DRAINAGE BASIN.

Along the Delaware; Bordentown to Florence.—From Bordentown to Florence the lowland on the New Jersey side of the Delaware is narrow, and the Cape May formation is chiefly in the valleys of the tributary streams, which have wide lowlands, relative to their own size. At Kinkora the Delaware lowland widens somewhat, though interrupted at Florence by a small area above the Cape May level.

The most distinctive thing about the Cape May formation between Bordentown and Florence is the absence of gravel of glacial origin. The filling of the Delaware Valley in the Cape May epoch, it will be remembered, was effected by (1) material brought down the Delaware, and (2) material brought in by tributaries to that stream. The central part of the valley received more of the sediment brought down the Delaware, and the sides more of that contributed by the tributary streams. The Cape May material on the east side of the river from Bordentown to Florence is of the latter sort.

Below Bordentown the filling of the Delaware seems not to have built the bottom of the valley up to 60 feet. From a maximum of 60 feet at Bordentown, the surface of the deposits of the epoch declines to about 40 feet at Florence. This may represent approximately the level of the sea during the later part of the epoch.

About Fieldsborough and Florence, the lowland along the Delaware, mostly below 40 feet, is covered with loam, 3 to 6 feet deep, much of which is heavy enough for brick. It is underlain by sand and gravel in some places, and its surface is more or less covered by eolian sand, as near Stevens Station. The loam is best developed at elevations of about 30 feet. At Fieldsborough and Kinkora there are extensive excavations at the brick yards, where the surface clay, which here replaces the usual loam, as well as the Cretaceous clay below, is used for brick. The surface clay overlies gravels of Cape May age. About a mile southwest of Kinkora a characteristic section shows:

- 3) 4 to 6 feet of eolian sand.
- 2) 5 to 7 feet of black clay.
- 1) 1 foot of Cape May sand.

The altitude of the surface here is about 30 feet above sea level, and the clay, which seems from its position to be the equivalent of the surface loams prevalent in the vicinity, is the last phase of the Cape May deposits here. Its exceptionally clayey character here and at few other points below, suggests slack water in spots at least during the epoch. Conditions for such deposits might arise just above the mouths of in-flowing streams

which brought in more sediments than the main stream could carry away promptly.

East of Florence, the Cretaceous is exposed at many places at elevations of 30 to 40 feet, but covered generally by Cape May gravel and sand, overlain by loam or eolian sand, or both.

Along the Delaware; Florence to Burlington.—Below Florence the area of the Cape May formation expands, and has a width of 2 to 3 miles, down to the mouth of Pensauken Creek. Gravel brought down the Delaware by glacial waters appears in this part of the valley.

A mile southwest of Florence and about half a mile back from the Delaware, a gravel pit in a low knoll at an elevation of about 30 feet shows 6 feet of gravel and sand, with many cobblestones. A third of the cobbles are of the type brought down the Delaware in the last glacial epoch,—granite, and bluish and blackish disc-like pebbles of argillaceous and arenaceous rock. Other excavations show characteristic Trenton gravel. The known depth of the gravel varies from 3 to 30 feet or more.

In and about Burlington, excavations to and even below sea level show gravel which is coarse in many places, with numerous cobbles, and many dark-colored (blue, grey, and black) pebbles of argillaceous and arenaceous rock, in the form of discoid pebbles. The sand accompanying has the black and red grains never seen east of the Delaware Valley. The sand has a greyish cast, unknown in southern New Jersey outside this valley. The same sort of gravel is found in the south bank of Assiscunk Creek, a mile and a quarter from the Delaware.

A mile northeast of Burlington and half a mile southwest of Stevens, at an elevation of 40 feet, there are fully 30 feet of Cape May gravel and sand, going down nearly or quite to sea level. The upper part of the deposit is of eastern materials, but the lower part contains gravel which came down the main valley.

Two miles east of Burlington, near the old York road, well-stratified sand, with sharp cross-bedding, is seen, but all of it is of local (eastern) origin. Glacial material seems not to have reached so far east.

Half a mile to a mile south and southeast of Stevens Station the surface of the Cape May formation is affected by an undulatory topography—sag and swell type—comparable to that affecting the Pensauken formation about Fresh Ponds. The surface elevation here is 30 to 40 feet, and the surface material precludes the eolian origin of the topography. It may be the result of the unequal settling of the underlying Cretaceous beds. Similar topography occurs at higher levels, as a mile and a quarter southeast of Bustleton, just north of the Burlington-Columbus road, at an elevation of about 80 feet.

Blacks Creek.—In the valley of this creek the Cape May formation appears on the right bank of the stream, constituting a fairly distinct terrace, the upland margin of which is ill defined in many places. In Bordentown the terrace reaches an elevation of 60 feet, and broader and more conspicuous terraces occur at 60 to 70 feet 2 or 3 miles up the creek. The well-defined terrace terminates about 3 miles above the city, where the creek changes its course. Farther up the stream, the volume of material referable to this formation is small, but it is found in meager development up Bacon Run nearly to Georgetown. South of Chesterfield and Blacks Creek, on the left banks of the several tributaries above, there is a considerable accumulation of glauconitic sand above the Cape May level,—at 80 feet south of Chesterfield and at 110 to 120 feet 2 miles farther southeast. The sand is disposed as a broad low ridge, and is probably eolian.

A mile from the Delaware, the Cretaceous surface in the slope of the valley is about 40 feet above the creek; 3 miles from the Delaware it is 25 to 30 feet above the creek; 5 miles above, 20 feet; and 7 miles above, about 5 feet. In other words, the lower end of the valley is lower now by some 40 feet than it was before the deposition of the Cape May formation, while 7 miles from the Delaware the depth of the valley is nearly the same as in the Cape May epoch. The left slope of the valley is higher and steeper than the right most of the way, and is covered with a thick mantle of loam, probably wind blown.

Loam covers the upland above the Cape May formation, and this upland loam appears to be continuous with that over the

Cape May terraces, though its character changes from place to place. Where the loam is thick, its surface is somewhat undulatory, with undrained depressions 2 to 6 feet deep. Even at high levels (180 to 200 feet) there is glauconitic loam at the surface, in places where it is not residuary, as on Miocene sand. This loam is well developed in the vicinity of Sykesville, and at some points on the divide between Sykesville and Springfield. The greensand constitutes 20 per cent. of the loam locally, though commonly much less. The eolian origin of this loam seems plausible.

Cape May deposits are developed along the small creek between Blacks Creek and Columbus Creek, but they possess no exceptional features.

Columbus Creek.—Cape May deposits extend up this valley nearly to Columbus, in a belt nearly a mile wide most of the way. Their surface rises from about 40 feet at the Delaware to about 70 feet at Columbus. Back from the Delaware the deposits are mostly on the right side of the valley. They are disposed in fairly distinct terraces with poorly defined upland borders, and with surfaces somewhat affected by eolian sand and loam. The depth of material is slight.

In Columbus there is glauconitic sand at the surface, and the same sort of material spreads to the south. Half a mile or so east of the village there is another body of similar sand mantling the divide south of the creek. These sands are comparable to those of south of Blacks Creek, and south of Rancocas Creek east of Mt. Holly.

Assiscunk Creek.—Cape May deposits are much more extensive in this valley than in the valleys of Blacks and Columbus creeks. The lower part of the valley, cut in the Raritan formation, is wide, while along the outcrops of certain overlying Cretaceous beds it is relatively narrow, as in the vicinity of Jacksonville. It widens again above Jacksonville, where its upper tributaries flow through broad flat tracts.

The general phenomena of this valley up to Jacksonville are like those of the valleys above. There are terraces, especially on the right banks, rising up stream. Their upland edges are

ill defined, and they are composed of gravel and sand, especially at their streamward edges, and they are more or less generally covered with loam. Wind-blown sand has modified the surface slightly. Where surface loam is present, it is like that at Kin-kora and Fieldsborough. The terraces along the lower course of the stream are only 30 to 40 feet above tide, but the corresponding deposits rise to 60 feet or more up the valley.

The broad flats above Jacksonville appear to be covered with deposits of Cape May age, but the material is not well defined or well exposed.

Northwest and southwest of Jobstown are two ridges rising to 80–85 feet, covered by glauconitic sand which is locally as much as 20 feet thick, though this is perhaps twice its average thickness. It is like the eolian (probably) glauconitic sand along the streams. There is a bit of gravel beneath the loam, doubtfully of Pensauken age. This glauconitic sand goes with that at various points in the region, ranging in elevation from 200 feet down.

Delaware Valley; Burlington to Pensauken Creek.—Between Burlington and Rancocas Creek, the lowland bordering the Delaware is an undulating plain 2 to 4 miles wide, covered with sand and sandy loam, much of which is wind blown. Locally a distinct though feeble dune topography is developed, as 2 to 3 miles south and southwest of Burlington. Beneath the surface sand, the materials are various, but gravel is common, containing some pebbles brought down the Delaware. The plain continues southward, with the same general characteristics, to Cambridge (below Riverside). Below Cambridge it narrows, but widens again at Riverton and Palmyra. A little southeast of Edgewater Park, a section is as follows:

- 4) 2 to 6 feet of sand, medium fine, yellow to brown, eolian.
- 3) 6 feet of black clay, horizontally bedded, but with laminae bent and distorted.
- 2) 10 feet of sand, the upper part very like number 4) above, the lower part containing some glacial sand.
- 1) Sand, with gravel—cobbles and bowlders. The stony material consists of quartz, sandstone, quartzite, and greywacke.

This section is like sections farther north except that the clay here is heavier. Except for the clay, the section is fairly normal for the region.

A few rods northeast of Edgewater Park Station, just north of the railway, there is gravel, containing even small bowlders. Pieces of Triassic shale, granite, and trap occur here, in addition to the sorts of rock enumerated above. It is worthy of note that the granites and greywackes do not look so fresh as those of the Trenton gravels generally. Similar gravel occurs in Beverly, and has been seen in temporary excavations down to depths of 10 feet. It may be seen in excavations generally between Edgewater Park and Delanco, near the river. One and a quarter miles southwest of Beverly depot, sections have been seen showing Trenton gravel (Cape May) over Pensauken, if interpretations are correct.

The gravel containing greywacke is seen again about Riverside, and at Riverton in the south bank of Pompeston Creek. Other exposures in Palmyra show greywacke gravel under the surface loam. To the southward, the sorts of pebbles characteristic of the Delaware glacial gravels become fewer and fewer.

From Burlington to Pensauken Creek, most of the Cape May formation which can be assigned to the Delaware Valley proper has a surface altitude of 30 to 40 feet, but in many places its surface has been built up by eolian sand to elevations somewhat above its original level.

Rancocas Creek.—The basin of this creek resembles the basin of Crosswicks Creek in some respects. The form of the basin, like that of Crosswicks Creek, is related to the character of the underlying formations. It is narrow where it crosses the marl series, but expands greatly above in the vicinity of Mount Holly. Arneys Mount, Mount Holly, and Mount Laurel are isolated elevations along the outcrop of the marl series, in place of the high belt in the corresponding position on Crosswicks Creek. The low flat in the basin of the upper Rancocas is larger than that in the upper basin of Crosswicks Creek, and it opens much more widely toward the Delaware lowland. These features are in keeping with the larger size of this creek, as compared with Crosswicks.

The development of this broad lowland in the upper part of the basin was accomplished before the Cape May epoch, and is represented in the vicinity of Pemberton, Vincentown, Lumberton, Medford, and Taunton. Through this lowland, the upper waters of the South Branch of the Rancocas had their courses in shallow valleys in the Cape May epoch. During this epoch, these several valleys were partly filled with sands and gravels brought down by their streams.

Between 2 and 3 miles from the Delaware, the Cape May formation is seen in excavations. It appears to represent material worked over from the Pensauken and older formations, and contains coarse materials, up to the size of boulders. It is not disposed in well-defined terraces. A mile and a half west of Rancocas village there is a distinct terrace at an elevation of about 25 feet, with coarse material (gravel and sand) above, and finer (glauconitic sand) below. Heavy brown loam, like that at Pemberton, appears up to elevations of about 30 feet, especially on the left bank of the stream.

In the vicinity of Hainesport, distinct Cape May sand and gravel occur at elevations of 40 feet or so, but the stream deposits are more or less covered by eolian sand. Between the eolian sand and the river sand and gravel, there is some loam, used as moulding sand. Just north of Timbuctoo, brick yards use a heavy surface clay, 2 to 6 feet deep, which overlies Cape May sand and gravel. The clay has an elevation of 30 to 40 feet. It corresponds to the Kinkora loam and the Edgewater clay, and overlies the gravel and sand of the Cape May formation in this region.

Glauconitic loam of uncertain origin and age overlies the divide at 70 feet, north of Timbuctoo. It overlies glauconitic sand which is well stratified, and carries a bit of gravel. In the vicinity of Mount Holly, the Cape May formation appears as a distinct terrace on the left bank of the stream, made up (as one-fourth of a mile southwest of depot) of 20 feet or so of stratified gravel and sand. Little distinctive Cape May material is found in the north branch of the valley above Smithville, and little in the south branch above Vincentown, though there are

local terraces at Smithville and Birmingham at 50 feet, and indistinct terraces probably of the same age, at Pemberton and New Lisbon at higher levels. Sand and loam, perhaps blown up from the Cape May level, overspread higher lands.

The left bank of the North Branch of the Rancocas is bordered from Pemberton to Mount Holly by a low ridge of sand similar to that in corresponding positions along Crosswicks, Blacks, and Doctors creeks. At Birmingham, the sand has been extensively worked for use in asphalt paving. It is coarse, sharp, of uniform grain, and very free from earthy matter. It forms a low ridge, the top of which is 60 to 80 feet above sea level. Its relations are the same as those of the sand along the south side of Crosswicks Creek at Crosswicks, and Blacks Creek at Chesterfield. These peculiar sands appear in other valleys above the point where the Cape May terraces are well developed.

Over broad areas at levels of about 60 feet in the vicinity of Pemberton, there is a covering of 3 to 10 feet of sand, gravel, and loam, of uncertain correlation, but apparently largely of Cape May age. It does not constitute a terrace, but a general, flatland covering. It is not much exposed, and its relations are not firmly established.

On the south slope of Arneys Mount, at an elevation of 150 feet, there is a considerable thickness (20 feet or so) of glauconitic loam and sand. Similar loam in much lesser quantity is found on other parts of the slopes of this mount, lying on Miocene sand. Its relations are the same as those of the green loam in the vicinity of Jacobstown and Sykesville, and its origin is doubtless the same. Farther north similar loam extends along the divide from Jacobstown to Sykesville, and thence to Springfield and Fountain Green. Within this general area, it reaches levels of 180 to 200 feet, without having well-defined limits. It is probably eolian, though the heaviness of the loam at many places does not at first suggest this origin.

In the basin of the South Branch of Rancocas Creek, the Cape May formation has greater development. It covers most of the area below 50 feet on both sides of the stream and its tributaries, and rises little up stream for considerable distances because

broad areas along the streams remain low up to Taunton (above Medford). Two or three miles above Medford the differentiation of the surface formations becomes impracticable. Up the creeks which extend eastward to Vincentown and beyond, the formation spreads widely, but remains low, mostly below 50 feet up to Buddtown on Stop-the-Jade, a mile above Retreat on Cedar Run, up nearly to Friendship on the creek of that name, and up to Beaverville, on Beaver Dam River.

The formation is best developed, and certainly best exposed, northwest of Hainesport. Here the gravels and sands rise to 30-40 feet, and go down to tide level. The formation makes up most of the material above sea level between the north and south branches of the stream back 2 miles or so from their junction. It is partly covered by eolian sand. The material exposed in the pits below Hainesport is well stratified. It is mostly sand, but seams of gravel run through it, locally developing into beds a foot or so thick. On the west side of the stream a mile above Hainesport similar materials appear, but their base is 10 to 15 feet above tide level.

Farther up the valley, the same relations hold, but the formation gets thinner and thinner as the surface of the underlying Cretaceous rises. In the vicinity of Eayrstown, the base of the gravel is about 30 feet above sea level, but the surface of the formation has risen less, and the formation is therefore thinner. At Lumberton, the sand and gravel are some 20 feet thick near the stream, but thin out back from the stream, with no well-defined upland edge. The stratification also is much more definite near the streams, disappearing or becoming indistinct toward the uplands.

Below Pemberton and Medford, both valleys were wide in the Cape May epoch. As the Delaware Valley was filled up, either by deposits or by water, the headwaters of both branches of the Rancocas, coming down from Miocene and younger beds to the east, brought much sand and gravel with which they aggraded their valleys. The formations accessible furnished much sand and little gravel, and the filling corresponds. After the streams reached the Cretaceous outcrops, materials from these formations

were added to the materials from younger formations brought down from above. Glauconitic is the contribution of the Cretaceous most easily recognized.

As the valley was aggraded by its stream, the side drainage, including general slope wash, was depositing its appropriate materials along the edges of the valley bottom at the bases of the valley slopes. This material was more strictly local. Thus it happens that in the central part of the valley at Eayrstown and Lumberton, much of the material was from the Miocene and younger beds above, while along the sides, more was derived from the Cretaceous.

Up stream, as at Chairville, the Cape May deposits run up to the level of Pensauken or post-Pensauken deposits, and become difficult of differentiation. As the valleys become narrower, the formation is less well developed, and merges into modern deposits.

Lumberton loam.—Years ago foundries began using loam obtained from the vicinity of Lumberton. It was obtained chiefly north of Lumberton, just beneath the soil which was stripped off to the depth of 4 to 6 inches. The value of the loam for this purpose was so great that foundry interests now control much land about Lumberton. In places the soil which is stripped off is replaced after the loam beneath is removed, and tillage goes on as before. This loam is found at the Cape May level, but is not so confined. It is dug to some extent up to levels of 80 feet. While not confined to the Cape May formation, therefore, it is characteristic of that formation, and appears to be connected with it in origin.

Swedes Run and Pompeston Creek.—Up Swedes Run, the Cape May formation rises to 50 feet or so a mile above Chesterville. Where the valley opens out into the Delaware lowland there is a terrace of 20 feet of gravel and sand on the south bank of the stream, at a level of 35 feet. Terraces at similar levels occur elsewhere along this run.

The phenomena in Swedes Run are duplicated in the valley of Pompeston Creek, whose Cape May deposits connect with those of Pensauken Creek east of Parry. The benches along

Pompeston Creek show that the Delaware here was filled up to the level of about 40 feet.

Pensauken Creek.—The Cape May deposits of this valley connect with contemporaneous deposits of the Delaware at Palmyra, and are continuous up to Mount Laurel and Cropwell. Their great expansion in area is between Moorestown and Mount Laurel, over the broad tract of lowland in this region.

Near North Pennsville there are feeble terraces, and they are continued for a mile or more to the east; but the depth of the Cape May deposits is slight, and they do not appear to correspond with the level to which the Delaware was filled in this epoch. They are probably remnants of plains of degradation developed after the Cape May epoch.

Up to the junction of the North and South branches of Pensauken Creek distinct terraces have little development; but between the North and South branches the formation is well seen, consisting of loose gravel and sand, rising to the 20–25 foot level.

Along the North Branch, between Lenola Station and Perry, there are many sharply defined bench-like areas at 20–30 feet, which have a thin covering of Cape May material; but along this branch the formation has little representation up to Moorestown. Above this place, the valley opens out into a wide flat, 30–50 feet in elevation, toward Mount Laurel, and this flat has a thin surface veneer of material which is probably to be correlated with the Cape May formation. In the vicinity of Wilsons Station there are distinct terraces at 20 to 30 feet, but they are of Cretaceous clays.

Along South Branch, Cape May terraces are better developed. The most conspicuous is on the north side of the creek, a mile or so west of the Moorestown-Ellisburg pike. The terrace here is 30 to 40 feet above sea level, but the Cape May sand and gravel are not more than 10 feet deep on the average. Good exposures of the formation have been seen half a mile west of Mapleshade in the east bank of the stream, in the point of the headland between Pensauken Creek and a small tributary which

enters from the northward; also south of Mapleshade and below the Moorestown water works.

The formation continues up the valley nearly to Cropwell where it reaches an altitude of 70 to 80 feet, but its upper limit is not well defined.

The left banks of both branches of Pensauken Creek are steep, and the right ones rise gently. The left banks, however, do not have distinct ridges of sand, like the valleys of Rancocas and Crosswicks Creeks.

The divide between the two branches of the creek west of the Moorestown-Ellisburg pike has a distinctly undulatory topography, at the 40 to 60-foot level. The region is underlain by a clay member of the Cretaceous,—the type of formation which underlies other areas of comparable topography.

Delaware Valley—Pensauken Creek to Coopers Creek.—Between these creeks the Delaware lowland is very narrow, and from Delaire to Pavonia nearly wanting most of the way. Below Pavonia the lowland and the Cape May formation expand, extending broadly up Coopers Creek to Cooperstown, and covering the lowland nearly to the headwaters of Newton Creek. The area of the formation along the Delaware narrows again between Big Timber and Little Timber Creeks.

The upper limit of the Cape May formation is not well defined everywhere, though at some points there is a topographic break which is assumed to mark its limit. It is not disposed in the form of a terrace or well-defined flat, and its surface has been somewhat modified by wind; but from Pavonia to Westville it covers the surface generally up to elevations of 40 feet or so. This may be looked upon as its normal level in the Delaware Valley here. At lower levels its surface has been degraded.

Coopers Creek.—Up this valley the formation rises from 40 feet near the Delaware, to 50 at Haddonfield, 70 at Gibbsborough, and even a little higher near the headwaters of some of the tributary streams. The material is disposed to some extent in the form of terraces, as 3 miles from the Delaware on the south side of the stream. The base of the formation here is below sea level, and its top about 20 feet above; but it is doubt-

ful if the present surface of the terrace represents the original surface of the formation. A little eolian sand mantles the surface at many points. Up the valley the phenomena of the lower part are repeated with such changes in composition of material and height as go with river deposits. Loam, mantles the upland back of the terraces, and appears to be continuous with the surface loam of the terraces.

Some 12 miles up the stream there is a high hill, 181 feet in elevation, capped with Bridgeton gravel, and mantled with glauconitic loams. Seams of sand are interbedded with the loam, and in some of these seams, more than half the material is green sand. This loam is like that on Arneys Mount (p. —), and in both cases is far above any present source. Either the glauconite has been carried up by wind, or sources which were once higher have been worn away. The former is the more probable. Green loam does not appear at the surface elsewhere in the vicinity.

Newtons Creek.—Most of the basin of this creek is below the level of the top of the Cape May formation. The low surface is covered with 5 to 10 feet of loam, sand, or gravel. The gravel and sand are chiefly near the streams, and the loam back from them. It is here impossible to separate Cape May material from that of lesser age, in any thorough-going way.

Big Timber Creek.—In the basin of this creek, the inter-stream areas are higher than in the basin of Cooper Creek, and the valleys are deeper, broader, and more trough-like. The left slopes of the valleys are higher and steeper than the right, though the difference is not as conspicuous as in the valley of the Pensauken, and some other creeks. The Miocene hills in the upper part of the basin, and the arenaceous beds of the Cretaceous, give the region a sandiness which does not facilitate the working out of its surface geology.

At the lower end of the valley the Cape May material extends below sea level. In the vicinity of Westville all the material above sea level is of this age. Farther up the stream the valley narrows, and the formation appears in narrow strips on one or both sides (chiefly on the right) up to Prossers Mills, where it has an elevation of 80 feet at least. Up the North Branch

it extends eastward to Laurel Springs and Clementon, and northward to Magnolia, reaching an altitude of nearly 100 feet.

A mile and a half east of Westville, the Cape May gravels and sands are well developed where a small tributary comes in from the south. The narrow belt between Big Timber Creek and Beaver Brook appears to be of the same sort of material. At Chews Landing and below, on the right bank of the North Branch, there is a Cape May terrace, with 10 to 15 feet of sand and gravel. A mile above Chews Landing the terrace is lower,—probably not retaining the original surface of the formation.

A mile above Chews Landing, the Cape May material is seen to be loose, clean sand, with a little gravel scattered through it, the whole well stratified. East of Chews Landing, there is a nearly continuous series of terraces (really one terrace interrupted by erosion), but exposures are few. At Laurel Springs and Garden Lake, the deposit is thin, and not sharply limited. Similar deposits border Otter Brook, rising to 60 to 70 feet.

A terrace of the same formation appears on the right bank of the lower part of Almonesson Creek, and in the main valley to the east. It is well developed just above the junction of the North and South Branches of Big Timber Creek, where its material has a thickness of 20 to 30 feet, and its upper surface a height of about 50 feet. In constitution it is very like the sand and gravel at Westville.

At Mechanicsville 20 feet of gravel and sand form a terrace whose surface is 50 feet above tide. Above Greenlock, Cape May sands and gravels rise to the Pensauken level, and the separation of the two becomes uncertain or impossible on topographic grounds. Much of the material in the upper parts of the valleys seems to have been brought to the valley by side wash, rather than by the current of the main stream.

The terrace remnants show that Timber Creek Valley was filled to 30 feet at Westville, to 40 feet at Clements Bridge, to 60 feet at Blackwood, and to about 70 feet at Turnersville, Clementon, and Laurel Springs. Loam, as the last phase of the formation, is less conspicuous here than along most of the

streams tributary to the lower Delaware. Eolian sand has modified the surface to some extent.

Woodbury Creek.—There are some terraces along the lower course of Woodbury Creek, but in many places the sands and gravels of Cape May age are not disposed in this form. Terraces appear where Mathews Brook comes in; also on the north bank of Woodbury Creek just west of Woodbury; but these are low and probably degradational. The Cape May sands and gravels are mostly on the north side of the stream.

Mantua Creek.—The Cape May formation of this valley merges into that of the Delaware proper a little below Berkley. At Berkley, and between that place and Paulsboro there is a terrace at 20 to 30 feet which appears to represent the upper limit of aggradation here during the Cape May epoch. It is doubtful, however, if all the lowland of the vicinity was ever built up to this level, though the lower end of the valley of Mantua Creek was.

The Cape May sand is well seen in a terrace 20 to 25 feet above tide a little west of Berkley, and in greater volume just above the junction of Mantua Creek and Edwards Run. The surface is much affected by wind-blown sand. Half a mile west of Mantua there is a terrace at 40 feet covered with about 10 feet of gravel and sand. There is a similar terrace half a mile east of Mantua.

Between Mantua Creek and Monongahela Brook, there is a terrace at 40 feet, covered with 20 feet of sand and gravel. A mile or so east of Wenonah, there is a terrace on the right bank of Mantua Creek, at an elevation of about 60 feet. Its upper 20 feet is of Cape May sand and gravel, loam-covered, resting on Cretaceous beds. The formation is represented up nearly to the sources of the streams which join to make Mantua Creek, that is up to points a mile or more above Hurffville, 2 miles above Dilkesborough, and a mile above Pitman Grove. The surface of the formation rises from about 40 feet at Mount Royal, to nearly 50 feet just above Wenonah, to 70 feet at Hurffville, to 90 or more at Dilkesborough, and to 120 feet east of Glassboro. Up Chestnut Branch it rises to 100 feet or so west of Pitman Grove.

In this basin, as in those farther north, there is a strong contrast between the steep left slopes of the valleys, and the gentler slopes on the right where the Cape May formation is chiefly developed.

Three or four miles back from the Delaware, the low divides between the tributary streams are covered with 2 to 4 feet of loam which was not derived from the formations beneath. Farther from the Delaware, the surface material on the uplands seems, in general, derivable from beds beneath. The loam over the Delaware lowlands seems much like that over the uplands. The latter may have been derived from the former, having been shifted and re-deposited.

The Delaware lowland between Mantua Creek and Raccoon Creek.—The Delaware lowland here has a width of 3 to 4 miles. Most of it is below 20 feet, but some parts rise to 30. Tidal marshes occupy half the area, and the remainder is covered with loam or sand, wind-blown sand being common. Along the streams there are in places 2 to 6 feet of sand and gravel; but it does not extend back far from the water courses.

In the region about Gibbstown, Repaupo, and Bridgeport, there is little material that can be definitely correlated with the Cape May formation. There is a thin veneer of loam in many places, a foot or two thick, which is perhaps to be so classed; but there are also areas of nearly bare Cretaceous at various levels, from 10 feet up.

Beneath the thin covering of sand and loam lies the Cretaceous. If all its superficial cover were removed, the Cretaceous surface would not be very unlike the present surface. The sand beds of the Cretaceous were doubtless the source of much of the sand which has been blown about, making district dunes in places, as half a mile southwest of Paulsboro, and about Bridgeport. It does not appear that deposition was ever heavy over this lowland, yet it is certain that the tributary valleys were filled up to what is now the level of 30 feet or so, where they join the Delaware lowland. If the Cape May deposits once filled the Delaware to the same level, they have been removed, and this seems hardly probable. The amount of post-Cape May

erosion which this hypothesis implies seems excessive. The alternative seems to be that this region was an estuary while the side valleys were filled, and that the central part of the estuary received little sediment.

The Cape May deposits cover most of the area drained by the smaller creeks, and form narrow borders along the larger ones which reach back into the higher land above Mickleton and Asbury Station.

Raccoon Creek.—The Cape May formation in this valley extends well up to the headwaters of the stream and its chief tributaries. Its surface rises from 30 feet or less on the Delaware lowland, to more than 100 feet above Ewans Mills, 5 miles above Mullica Hill.

On the Delaware flat and in the lower part of the Raccoon Valley, the Cape May material is not abundant. It consists of gravel and sand which cover the Cretaceous beds to the depth of a few feet. The gravel is more abundant near the stream, and finer material farther from it. The material takes the form of terraces, or covers Cretaceous benches, but its surface does not rise much above 40 feet up to Swedesboro. Half a mile below this place, the sand and gravel are 20 feet deep, and the surface of the terrace about 35 feet above tide.

Just west of Swedesboro, on the south side of the stream there is a remarkably flat terrace at about 30 feet, composed of well stratified, incoherent sand and gravel. The gravel is fine, the pebbles being mostly less than an inch in diameter, and clean and fresh. The valley here was built up to 35 feet or so during the epoch, with material brought down by the stream. The material of Raccoon Valley is *coarser than that of the Delaware*, where there may have been an estuary, or, at most, a very sluggish current, at the time.

A mile and a half above Swedesboro there is also a distinct terrace at about 35 feet; but the depth of sand and gravel is only 10 feet, and there is more gravel than below. All the stony material is of resistant sorts,—quartz, chert, ironstone, etc. A layer of mud appears in the section here, near its base.

A quarter of a mile below the mouth of the South Branch of Raccoon Creek there is a distinct terrace at 50 feet, but only the uppermost 10 feet or so of its material is younger than the Cretaceous. A mile below Mullica Hill there is a conspicuous bench at 60 feet, with 10 feet of gravel and sand over the Cretaceous.

Farther up the creek and its tributaries, the phenomena of their lower courses are continued at higher levels. In general, the deposits are not so high above the streams in their upper courses, but their elevation above sea level is greater. As in most of the other valleys, the Cape May deposits are mostly on the right banks of the streams.

The Salem Plain.—Below Camden, the Delaware plain has not a heavy covering of the Cape May formation. In general it is thinner above Raccoon Creek than below. Above, it ranges from 0 to 20 feet, though rarely more than 10 feet. The Cretaceous appears at the surface in many places; but below Raccoon Creek, and especially below Oldmans Creek, the Cape May gravel, sand, and loam, form a nearly continuous cover. This cover transforms the plain into good farming land, as in the vicinity of Salem.

Oldmans Creek.—In the valley of this creek, the formation here under consideration rises from an elevation of about 30 feet where the valley joins the Delaware lowland, to 90 feet or so at Avis Mills. In keeping with the general configuration of the valley, it appears mostly on the north side of the stream. It constitutes terraces in some places, but more commonly it caps benches of Cretaceous strata, shaping them up into terrace form, by building up their streamward edges.

Where the valley joins the Delaware lowland, there is a 20-foot terrace of gravel and sand on the left bank of the stream, affected by more or less eolian sand. At Auburn there is a bench on the north side of the stream, at 35 feet, and the formation goes down to within about 10 feet of tide level, and has a bed of clayey matter near its base. At Harrisonville Station, 7 feet of stratified gravel and sand are referred to this formation. On the left bank of the stream at this point 4 feet of greenish marly

loam overlies gravels of greater age than Cape May, and at higher levels. Between Harrisonville Station and Harrisonville, there is a bed of clayey matter in the terrace of the headland between Oldmans Creek and the tributary from the south. At Harrisonville the Cape May gravels and sands rise to 70 feet; but here and farther up the valley, the differentiation of Cape May gravels from the valley phase of the Pensauken is difficult.

Salem Creek.—The phenomena along Salem Creek duplicate those along the creeks farther north. Where the valley merges into the Delaware lowland a mile or so below Sharptown, the Cape May formation reaches an elevation of about 30 feet, though much of its surface is lower. It rises to 50 feet at Woodstown, 70 feet at Richmanville, and 80 to 90 feet 2 miles farther up. The formation is developed chiefly on the right banks of both main and tributary streams (Majors Run and Nihomus Run). South of Woodstown the formation of the main valley joins that of Nihomus Run to the south.

At Courses Landing 10 feet of well-stratified fine gravel and sand appear on the left bank, while on the right, 10 to 15 feet of stratified gravel is covered by 5 to 10 feet of eolian sand. Beneath the lower gravel and sand is gritty clay, probably also of Cape May age.

At Sharpstown, there is a terrace at 25 feet, with 10 to 15 feet of sand and gravel over clay marl. Just east of Woodstown, there are terraces on both sides of the stream at 50 feet, with 10 to 20 feet of Cape May sand and gravel; and at Richmanville at 60 feet, on the right bank. There are other terrace remnants a mile and a half above the last-named place.

Mannington Creek.—A mile and a half from Salem Creek, the left bank of Mannington Creek shows 20 feet of gravel and sand, referable to the Cape May formation. This material is singular for its considerable content of cobbles and boulders. One boulder was seen here, with glacial striæ on two sides. At Welchville there is a 20-foot bench in which exposures show, near the base, sand which is not distinguishable from Pensauken sand.

In general the Cape May mantle in the valley is thin, and back from the streams is of clay and loam. It connects with that of Alloways Creek by way of Alloway Station.

Alloways Creek.—A mile below Quinton, a section in the flat at 20 feet shows

- 2) 3 feet of brown sandy loam.
- 1) 6 feet stratified white sand, with seams of fine gravel.
- Base unknown.

This is fairly typical for the Cape May formation of this region.

A mile and a half above Quinton a section in the 25-foot terrace shows

- 2) 3 feet brown sandy loam.
- 1) 7 feet yellowish sand, coarse and fine, carrying seams of fine gravel, horizontally stratified.
- Miocene, surface 10 to 15 feet above tide.

Half a mile west of Alloway, there is a terrace at 30 to 35 feet, which shows 20 to 25 feet of gravel and sand, underlain by Miocene clay. At Alloway, the Cape May terrace has an altitude of 40 feet. Above Alloway, the formation has some development up to altitudes of 50 feet, but not along the stream. It is seen to rest on the Miocene at some places.

Cohansey Creek.—South of Salem Creek, the Cape May formation expands to the eastward, and borders the bay much as it borders the river farther north. It is found along Cohansey Creek in a narrowing belt up to Dutch Neck, with an upper limit of about 40 feet. It covers a considerable area on the west side of the creek between Dutch Neck and Bridgeton, rising nearly or quite to 50 feet at the latter place, and to 60 or 70 feet near Cedar Grove. Above Bridgeton, however, its development is slight and in most places not very distinct.

On the right bank of Cohansey Creek the Cape May formation covers all the lowland south of Fairton, and overspreads a belt several miles wide along the bay farther east. Its landward limit, roughly defined by the railway from Fairton to Mauricetown Station, has an elevation of about 40 feet; but

most of the tract covered by it between Cohansey Creek and Maurice River has an elevation of less than 20 feet.

Maurice River.—Up Maurice River it appears in a characteristic way on both sides of the stream nearly to Franklinville, and perhaps beyond, though it here becomes indistinguishable. It covers a belt several miles wide up to Millville, and a narrower belt farther north. It also covers a wide belt in the lower parts of the valleys of Manumuskin and Manantico creeks, extending up nearly to Bennetts Mill in the former valley, and to Hange's Bridge in the latter.

In the valley of Maurice River it attains an elevation of 90 to 100 feet in the vicinity of Porchtown and Malaga, 90 feet at Union Grove on the tributary east of Rosenhayn, and about 60 feet in the valleys of Manantico and Munumuskin creeks.

The material of the formation was derived from the Bridge-ton, Pensauken, and Tertiary formations of the drainage basin. It is sandy for the most part, and but little of the land covered by it is cleared. There are few exposures, and detailed study of it has not been made. Eolian sand affects its surface at some points, as along the railway west of Vineland.

East of Maurice River the formation expands widely, covering most of the area south of a line running from Manumuskin to Great Egg Harbor, though an area of a few square miles east of Bricksboro rises above the level of the formation, which seems to be limited approximately by the 40-foot contour.

IN THE ATLANTIC DRAINAGE BASIN.

Great Egg Harbor River.—The formation extends up the valley of Great Egg Harbor River to Weymouth, several miles above Mays Landing, in a broad belt on both sides of the stream. In narrower and ill-defined belts, it is found still farther up the valley, but it nowhere rises above 50 feet or so, in distinguishable development. Above Weymouth it is doubtless represented under the marshy bottoms of the valleys.

Between Great Egg Harbor River and Toms River.—East of Great Egg Harbor River, it is limited chiefly to elevations below 35 feet. It expands in bay-like form in the lower part of

the valley of Patcong Creek. In the vicinity of Pleasantville, older formation (above 35 to 40 feet) extend out to within less than a mile of the salt marshes, but the formation expands again over a bay-like area in the lower part of Absecon Creek, extending up to Doughty's and beyond. Just above Absecon it narrows to belt less than a mile wide at Leeds Point, but expands greatly in the valley of Mullica River, above Great Bay. Here it covers a large area of lowland, from Leeds Point to Smithville, Hewittville, Unionville, and Batsto. It extends up Wading River, tributary to the Mullica, several miles above Harrisonville, reaching an elevation of more than 100 feet, and covers most of the area south of a line from Harrisonville to Nugentown. In most of this area it is confined to levels slightly below 40 feet, but near the heads of the valleys it rises a little higher. It is hardly recognizable above elevations of 50 feet. West of Tuckerton there is an area of some older formation (Pensauken?) rising above the Cape May level (40 feet).

There is some expansion of the formation up the valleys of Shords Mill Brook above Tuckerton, and up Westecunk Creek above West Creek. A mile north of Cox's Station, older formations extended east to the railway, and the Cape May border is narrow to Manahawkin, being restricted virtually to the coastal belt less than 35 feet in elevation. At Manahawkin it again widens, but to the eastward, rather than inland. Cape May deposits here are hardly separable from younger deposits.

The formation is wanting some of the way between Manahawkin and Barnegat, but from the latter place to Toms River it forms a belt 1 to 2 miles wide most of the way, and expands up Ewing Valley, holding quite strictly to levels of less than 40 feet along the coast, but rising slightly up the valleys. Up Cedar Creek, for example, it reaches an elevation of 60 feet at Dover Forge, and more than 100 feet at Webbs Mill.

Toms River.—About the mouth of Toms River, the Cape May formation retains its habits of the region farther south, being restricted to the area below 35 feet along the coast, and covering most such areas.

Island Heights is of older beds, but the Cape May formation extends up Toms River and its principal tributaries, in rather

narrow belts on both sides of most of the valleys. Up Davenport Branch, it is restricted chiefly to the left bank, and reaches an altitude of more than 100 feet a mile or two southeast of Whitings. It reaches an altitude of 70 or 80 feet at Lakehurst, on Union Branch, and above that point merges into the upper marshes. It reaches an altitude of 70 at Ridgeway Station, and the same elevation up Toms River 2 or 3 miles above White's Bridge. Here, too, it passes into the swampy tracts up stream.

From Toms River to Manasquan River.—Here the formation is much more extensive along the coast than farther south, covering a belt 5 or 6 miles wide west of Mantaloking and Pleasantville. Landward, its margin rises somewhat higher (40 to 50 feet) than farther south. It reaches an altitude of 70 feet or so about Farmingdale on the Manasquan, and 100 feet 8 miles farther up. Along this stream it is developed chiefly on the north side.

Between Manasquan River and Little Shrewsbury River.—North of Manasquan River the formation constitutes a belt a mile or so wide, bordered next the sea by modern beach deposits. Above Allenhurst, it covers much of the wide area below 40 to 45 feet. But here, as along Whale Pond Brook and the little stream just south of Elberon, the streams have cut through the young formation, exposing the Cretaceous beneath. In this stretch, therefore, the lower parts of the valley slopes, and the elevations which rise above 40 to 45 feet, as at Long Branch Village, are not covered by the formation.

Along Rumsons Road, from Sea Bright to Little Silver, the covering of recent deposits over Cretaceous is thin, especially at levels above 40 feet. About Little Silver, the area which may be mapped as having a cover of Cape May material is large, but the amount of material is small.

Along Parkers Creek, at the head of Little Shrewsbury River, a thin covering of sand, gravel, and loam over the Cretaceous, is to be correlated with the Cape May formation. It includes some eolian sand, and is chiefly on the south side of Parkers Creek and Wampum Brook. It extends up to Eatontown and beyond, and is mostly below the level of 40 feet; but some of the

land below this level is essentially bare Cretaceous. About Eatontown, the Cretaceous beneath the Cape May is sand, and easily shifted by the wind. Eolian sand is here much in evidence without being in great quantity. About Eatontown, the Cape May formation is ill defined, and not more than 3 or 4 feet thick, mostly sand.

About Oceanport the relations are about as at Eatontown. A few feet of sand, much of which looks as if it might be weathered Cretaceous, overlies sands known to be Cretaceous. A little gravel below the upper sand indicates that it is a surface accumulation rather than a weathered mantle.

From Oceanport to Long Branch, the Cape May formation covers much of the surface below 40 to 50 feet, though no contour line can be said to mark its limit; nor does it cover all the surface at lower levels. Some of the valleys below the 40-foot level appear to have been developed since its deposition, and have been cut through it into Cretaceous beds below. Along the shore, too, there is a margin of land made up of sand and gravel younger than the Cape May—the modern beach deposits.

The low but conspicuous little hills in the vicinity of Long Branch at elevations of 60 to 70 feet are of Cretaceous sand. Rising abruptly above their 20 to 30-foot surroundings, they seem like considerable elevations. Over the lowlands there are 3 to 6 feet of sand, derived chiefly from the Cretaceous of the vicinity. Some of it is eolian and underlain by a bit of gravel ranging from a trace to a few inches in thickness. Nowhere in the vicinity are there considerable beds of gravel referable to the Cape May formation. There are beds of sand and gravel 20 to 30 feet thick along the beach, but they are recent. The beach line is built against the mainland, instead of out from it, as farther north.

In the vicinity of West Long Branch, the following sections are fairly typical:

1. 3) 3 feet of compact fine gravel, sand and loam.
 - 2) 1 foot greenish-brown loam.
 - 1) 1 foot loose gravel and sand, of Cape May type.
- Cretaceous.

2. 2) 2 feet yellow-brown clay loam, with a few pebbles.
- 1) 4 feet gravel and coarse sand, well stratified. Some cobble stones. Cretaceous.

West of Elberon, the Cape May cover has a thickness of 12 feet at least in places, but this is probably above its average. Such gravel as it contains is largely at its base, and as a formation it is ill defined. The whole situation here seems to suggest either (1) a filling by gravel wash behind a beach 30 to 40 feet high (now chiefly east of the railway between Long Branch and Manasquan), or (2) a gently sloping plain covered by wash against which a beach was built. The material back from the beach seems older than the beach itself, and this seems to favor the second alternative.

Half a mile west of Elberon, 6 to 10 feet of sand, gravel, and loam overlies the basal remnant of Miocene. The Cape May material is mostly well stratified, and not unlike that along the coast farther north, where terrace forms were well developed.

On the south side of Poplar Brook there are terraces at 30 to 40 feet which consist of glauconitic sand, 3 to 8 feet thick, underlain by a little gravel, and this by Cretaceous marl. Between Poplar Brook and Deal Brook the underlying terrane shifts from Cretaceous to Miocene, the base of the latter being about 20 feet above sea level along Deal Creek, near the coast. Between Poplar Brook and Deal Brook, the Cape May material is poorly defined in most places, as over most of the area between this point and Little Shrewsbury River.

About Edgemere there are about 4 to 6 feet of material which may be regarded as Cape May, overlying Eocene marl.

Asbury Park stands on the modern beach deposits. On the south shore of Deal Lake, the Eocene marl outcrops, and to the westward it appears at higher and higher levels. It is covered by scant deposits of gravel and sand, which thin westward as the surface of the marl rises.

At West Park, near the top of the 44-foot area, a remnant of Miocene appears, its base having an altitude of about 25 feet, and the surrounding lowland at the Cape May level is of this formation, thinly covered with sand and loam, not older than

the Cape May formation. In other words, the relations at Asbury Park are much the same as at Edgemere and South Elebron. The beach sand and gravel rest on a sloping surface of Eocene marl, the top of which is below sea level for half a mile or so back from the shore. These relations continue to Shark River.

The same relations hold in general from Shark River to Manasquan River. There is a belt a mile and a half wide next the shore, mostly below 30 feet. The shore-ward half of this belt is modern sand and gravel, the land-ward half a sloping surface of Miocene, covered by a thin mantle of sand and gravel of Cape May age, which thins westward.

Shrewsbury and Swimming Rivers.—The Cape May formation has some representation in all the principal tributaries of the Swimming River, and a larger development east of Red Bank, bordering the bay called Shrewsbury or Navesink River. Indeed it covers much of the peninsula between the Shrewsbury River, and the wider bay to the south called Little Shrewsbury River.

At the lower end of Swimming River the formation has an elevation of about 40 feet in the vicinity of Red Bank, but rises progressively up stream to 160 feet near the headwaters of some of the branches of Hop Brook, heading in the Beacon Hill region. Along Yellow Brook and Pine Brook, the other branches of Swimming River, it does not rise so high, obviously because these creeks do not head in such high land.

Between Oceanic and Red Bank there are more or less distinct terraces along the coast at levels ranging from 20 to 40 feet. These are composed of 10–20 feet of Cape May material over a Cretaceous bench. Red Bank stands on a terrace of this sort. There are similar terraces on the north side of Shrewsbury River, especially at the lower ends of tributary streams. In height and constitution these terraces are like those at Atlantic Highlands, Cliffwood, and Lawrence Harbor (see below), and doubtless are one with them in origin. Sections show well-stratified sand and gravel. These conditions suggest a stand of the land once 40 feet lower than now, at which time there was some accumula-

tions of sand and gravel just above the water, up to what is now 50 feet, more or less.

In the valley of Clay Pit Creek, there is a good deal of gravel referable to this formation, especially near the Shrewsbury River, where it is more than 30 feet deep in places. In the valley of the larger creek west of Clay Pit Creek there is a considerable body of gravel on the east side, and on the bank of the Shrewsbury at its lower end; but it does not take on a distinct terrace form at most places. Terraces are more distinct a mile and more up the valley, at altitudes ranging from 50 to 70 feet.

Due north of Red Bank there are distinct terraces at elevations of 20 to 30 feet, but they are composed of Cretaceous beds covered but thinly with younger sediments. Cape May sediments appear, however, at the lower ends of Poricy and Nut Swamp Brooks.

In contrast with the phenomena of the smaller streams, there are terraces up the valley of Swimming River and its main branches for many miles. They are low, composed wholly of Cape May sands and gravels in some places, while in others a thin coating of sediments of this age covers the local Cretaceous formation. The terraces rise progressively up stream, maintaining a height of 20 to 40 feet above the channel of the river.

Up Swimming River to the junction of Yellow Brook with Hop Brook, the formation has considerable development on both sides of the stream, forming low terraces or overspreading the lower slopes of the valley, and reaching elevations of 40 to 50 feet. Just below the mouth of Hop Brook, the thickness of the formation is as much as 20 feet on the north side of the stream. Below Phalanx, the terraces are clearly correlated with the 40-foot terraces about the coast, with which they are nearly continuous.

Hop Brook.—In the valley of Hop Brook, up to the junction of its several principal branches, the formation is disposed as in the valley of Swimming River, rising however to higher levels (70 feet), with indefinite upper limits. There are more than 20 feet of well stratified gravel and sand at some places, while in others the formation is represented by no more than a thin

coating over Cretaceous benches. In the valleys of the several streams which join to make Hop Brook, the formation is represented best along the streams from the north.

At and above the junction of the three principal branches of Hop Brook, the terrace material is abundant, and rises to 90 feet on the slopes. There is here some suggestion of terraces at different levels, but they are not persistent. Up the brook that has its source near Crawfords Corner, the deposits are almost continuous from Phalanx to the heads of the valleys, rising to elevations of 160 or 170 feet. The deposits are rarely 10 feet deep, but are so disposed on the sloping surface of the Cretaceous as to develop feeble terraces. The terrace form is distinct opposite the mouth of Willow Brook, and opposite and just south of Holmdel, where the altitude is 90 feet. The material is glauconitic sand and gravel, the latter containing much ironstone, which looks as if freshly worn. A mile northeast of Holmdel, just west of the 157-foot hill, 20 feet of the formation have been seen in temporary exposures, the material being loose sand and gravel. Comparable depths are shown at a few points farther north.

On the whole, the deposits of this valley are what might be expected along a stream heading in such high hills of loose material. They are not such as to demand a special epoch of deposition. It is to be noted that the terraces rise up the stream (30 feet at Phalanx to 170 at Crawfords Corner) at a rate which is harmonious with the gradient of the stream.

Willow Brook.—This branch of Hop Brook heads in the high hills about Beacon Hill, and has a high gradient down to its junction with Hop Brook. At the junction of Hop Brook with the brook from Crawfords Corner, the surface of the Cape May formation has an elevation of about 60 feet between the two creeks, and its base an elevation of about 50 feet. For 3 miles up stream, the right bank of Willow Creek has little Cape May material but along the left bank, the lower part of the slope is mantled with it. Near the stream, sands and gravels predominate, and back from the stream, loam.

The material of the terraces is best exposed northwest of Holmdel, where the brook forks. Between the forks, an exposure showed 4 feet of brownish loam, rather clayey, over 10 feet of glauconitic sand and gravel, well stratified. The 14 feet of material referable to the Cape May formation here is more than the average, but in kind it is similar to that seen at other points.

The above section is at an altitude of about 130 feet, and about $1\frac{1}{2}$ miles from the headwaters of the creek. Farther up the valley corresponding deposits, except of coarser materials, are found up to 180 feet, and perhaps even to 230 feet. This material is clearly waste from the higher lands, temporarily lodged on its way to the sea. Much of it is of recent deposition.

In general the Cape May material along Willow Brook is on benches of Cretaceous strata 10 to 30 feet above the streams. The creek has cut down through the filling, and 10 to 30 feet into the Cretaceous below. The terraces indicate either a slightly lower stand of land when the filling took place, or a condition which favored more erosion than now, near the headwaters. The relations of the formation here are much as in other brooks hereabout, except that there is rather more material in this valley than in most of the others. The explanation of this difference is found in the higher lands in which the brook heads.

Yellow Brook.—The Cape May deposits along Yellow Brook are less considerable than those along Willow Brook, as already implied. The deposits are represented in the area between Hop Brook and Yellow Brook, and at intervals up the valley to Colts Neck; but they are thin in many places, even where distinct. Even where terraces are fairly distinct, they are not in all cases of Cape May material chiefly. No section showing more than 10 feet of this material has been seen on the north side of the valley, the thickest being east of north of Colts Neck. The formation does not appear to rise higher than 90 feet at Colts Neck.

On the south side of the brook, north of Scobeyville, there is a terrace at 50 to 60 feet, which shows the following section:

- 4) 5 feet eolian sand.
- 3) 8 feet gravel and sand, well stratified; ironstone conspicuous.
- 2) 1 foot glauconitic sand, with laminæ of clay.
- 1) 3 feet fine gravel and sand.

Up the creek which heads near Wickatunk, there is some Cape May material rising to nearly 170 feet at Wickatunk. At the lower end of the brook, the material runs up the slope to about 80 feet. For $1\frac{1}{2}$ miles above the lower end of the brook, there are terraces at 80 to 90 feet, with 10 feet or less of sand and gravel. There is more of the Cape May gravel and sand on the north than on the south side of the valley, depths of 8 to 10 feet being seen at various points. The material is glauconitic.

Pine Brook.—Cape May gravel and sand are found up Pine Brook to a point 2 miles above Tinton Falls. At the lower end of the brook there is 20 to 30 feet of terrace material, at the 40- to 50-foot levels. Up to Tinton Falls and above, the deposits are mostly on the north side of the stream, where there are meager and indistinct terraces, ranging from 40 feet in elevation to slightly higher levels. Above Tinton Falls there are terraces at 50 feet, but the Cape May material is thin.

There is a good deal of eolian sand in the valley of Pine Brook, as on the area between Pine Brook and Hockhockson Brook.

Just west of Macedonia, in the vicinity of Pine Brook Station, there is an area from 70 to 85 feet in altitude, covered with 6 to 10 feet of glauconitic sand, largely eolian. Its source is probably the "Yellow" sand of the Cretaceous, a local phase of the Vincentown formation. Other areas of similar glauconitic sand are known in the vicinity, as between Colts Neck and Tinton Falls. The 90-foot areas east and west of Scobeyville, for example, are mantled with it. A bit of gravel occurs at the base of the sand in many places.

IN THE LOWER RARITAN DRAINAGE BASIN.

Manalapan and Matchaponix creeks.—Along Manalapan Creek the Cape May formation has some development up to the vicinity of Englishtown, but it occurs in patches only, now on one side of the stream and now on the other, down to Jamesburg. From Jamesburg down to Old Bridge it is widespread, but thin and low, mostly below 30 feet.

Most of Jamesburg stands on a terrace of this material. There is a distinct terrace east of the Upper Jamesburg depot, at the 60-foot level. The Cape May gravels and sands are deepest near the stream, and thin out back from it, as the surface of the Cretaceous rises. The material is such as Manalapan Creek could have gathered from its upper basin. The phenomena at Jamesburg and farther east suggest conditions which allowed much accumulation of sediment here at the 60-foot level in this epoch, while much less was being deposited farther down the valley. Between Helmetta and Old Bridge a thin bed of the formation covers a wide low tract at an elevation of 30 feet or so, but the amount of material is small, Cretaceous beds appearing at many points in the 20- to 30-foot flats. In general it may be said that most of the surface in this region below 40 feet is covered by a thin and somewhat discontinuous body of sand and gravel referable to this formation, though its age is not determinable with precision.

In the valley of Matchaponix Creek, the Cape May deposits extend up to Texas, and interruptedly beyond; but there is nowhere a deposit corresponding in quantity and height to that at Jamesburg.

The phenomena between Jamesburg and Old Bridge do not seem to be altogether in harmony with those at Jamesburg, if the Cape May formation is all the work of rivers. Has most of the formation below Jamesburg been removed by erosion? This seems hardly likely, in view of the great amount of erosion required, and in view of the low altitude, which would hardly have favored the removal of so much material as this hypothesis demands.

The phenomena between Spotswood and Old Bridge are continued east of Old Bridge, affecting most of the surface of the low area (below 45 feet or so) nearly to Brownstown. The formation also borders South River on the east, in a narrow belt down to the Raritan.

Lawrence Brook.—In the valley of Lawrence Brook the formation has little representation above Westons Mills, but it has some slight development between the lower end of the brook and the mouth of South River. The amount of material is small, and reaches levels of 60 feet (about the same as at Jamesburg), but does not cover all the surface up to this level. It is shown as well as anywhere on the island near the mouth of the brook, an island having a maximum altitude of 44 feet. Its top is covered with Cape May sand and gravel, though its basal part is Cretaceous. The Cape May material here contains no northern material, such as is found on the north side of the Raritan, and up the Raritan to Bound Brook. Traces of Cape May benches are to be found at various points up Lawrence Brook, but they are trifling both in extent and in amount of material. In this respect, Lawrence Brook is in contrast with most of the streams of southern New Jersey. The absence or paucity of the late deposits in this valley probably is the result partly of lesser deposition at the outset, and partly of greater erosion since. The formations, the topography, and the situation of the basin of this brook with reference to glacial drainage, all contribute to this view. On the other hand, if the region were submerged to 60 feet, little deposition would need to have taken place in the narrow strait which would have occupied this valley.

Raritan River.—The remnants of glacial gravel below Bound Brook, up to altitudes of 60 feet or so, suggest that the lower part of the Raritan Valley was filled with sediment during the last glacial epoch, up to elevations corresponding with the filling of the Delaware; but this conclusion is not altogether decisive. If there was such filling, the deposits have been almost wholly carried away; there is even less glacial gravel down the Raritan than up the Millstone. There is also the question as to whether the valley was drowned to the level of 60 feet, allowing trans-

portation of glacially derived gravels along the shore of the narrow bay thus formed.

At the mouth of Mill Brook, on the north side of the river, there are terraces comparable to those at the mouth of Lawrence Brook on the south side, in both places at or near the 60-foot level. The terraces at the mouth of Mill Brook contain no glacial material brought down by the Raritan.

Below South River, the Cape May formation has some representation east of Sayreville, and thence along the bank of the river to South Amboy, being confined to levels below 40 to 50 feet. Well-defined terraces are wanting.

It is not demonstrable from the phenomena now presented by this valley, either that submergence did or did not affect this region in the last glacial epoch. It seems clear that glacial waters went from Bound Brook up the Millstone at that time, either as a river, or through a narrow strait. If the latter, they must have gone down the Raritan also, cutting off the southern part of the State from the northern by a narrow strait. The phenomena farther south do not seem to give this hypothesis firm support.

South shore of Raritan Bay.—The Cape May formation has little representation on the south shore of Raritan Bay from South Amboy to Keyport, though it appears in a few small areas, and in some places, as at Morgan, Lawrence Harbor and Cliffwood, in well-defined terraces, at elevations of 30 to 40 feet.

South and east of Keyport its development is more considerable. It extends up Matawan Creek, reaching an elevation of 50 feet, a mile above Matawan. It covers a considerable area east of Keyport, mostly below an elevation of 40 feet, and extends up the valley of Waycane Creek for 4 miles. It is mostly on the east side of the valley, and covers most of the lowland (below 40 feet) between Keansburg and Bedford. Farther east, it covers a belt from Atlantic Highlands across the peninsula by way of Navesink and Clay Pit creeks, to Shrewsbury River, rising to altitudes of 50 feet or so at its higher points.

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Document No. 49

Eleventh Annual Report

OF THE

Commissioner of Motor Vehicles

1916

Eleventh Annual Report

OF THE

Commissioner of Motor
Vehicles

TO THE

LEGISLATURE OF THE
STATE OF NEW JERSEY

FOR THE YEAR ONE THOUSAND NINE HUNDRED AND
SIXTEEN

TRENTON, N. J.
MACCRELLISH & QUIGLEY Co., State Printers

1917.

REPORT.

To the Legislature of the State of New Jersey:

GENTLEMEN:—I beg to respectfully present herewith a report of the work of the Department of Motor Vehicles for the year ending December 31, 1916, as required by Chapter 113, Section 12, P. L. 1906.

FINANCIAL STATEMENT.

COLLECTION ACCOUNTS.

Paid State Treasurer,	\$1,368,057 98	
Cash on hand December 31, 1916,	277,911 42	
Commissions of agents from January 1, 1916,	\$29,051 66	
Previous to January 1, 1916,	12 50	
	<hr/>	29,064 16
Due from banks,	208,656 06	
Agents' bank balances,		\$208,656 06
Collections, 1915 business,		4,739 26
Collections, December 1, 1915, to December 30, 1916,		1,402,066 80
Collections on account of 1917 business,		268,227 50
	<hr/>	<hr/>
	\$1,883,689 62	\$1,883,689 62

DETAIL AND CHARACTER OF COLLECTIONS, DECEMBER 31, 1916.

Items.	(By Agents.)	
104,341 car registrations, classified as follows:		
638 first class, pleasure,	\$2,796 75	
593 first class, commercial,	2,623 50	
74,183 second class, pleasure,	530,741 25	
9,970 second class, commercial,	71,070 00	
16,565 third class, pleasure,	242,932 50	
2,392 third class, commercial,	34,845 00	
	<hr/>	\$885,009 00
5,073 trucks in excess of 4,000 pounds,	50,730 00	
12,209 motor cycle licenses,	24,418 00	
807 manufacturers, three sets,	12,105 00	
107 manufacturers, five sets,	2,675 00	
321 trailer licenses,	963 00	
20,957 transfers,	29,233 00	
3,086 duplicate certificates,	3,086 00	
3,162 duplicate markers (automobile and motor cycle),	2,889 00	

4 COMMISSIONER OF MOTOR VEHICLES.

137,855 drivers' licenses, classified as follows:

105,788, first class,	\$211,576 00	
12,067, second class,	128,268 00	
		<hr/>
3,272 drivers' licenses increased,		\$339,844 00
3 drivers' license badges,		6,544 00
*Miscellaneous collections,		1 50
*Miscellaneous collections,		76 25
Interest on deposits—agents,		757 98

(By Central Office.)

		<hr/>	\$1,358,331 73
Interest on deposits,	\$922 46		
Certified copies,	56 50		
Blanket licenses,	100 00		
Fines for violation of the law,	41,161 10		
*Adjustment of fees,	1,279 75		
*Miscellaneous receipts,	210 76		
Special Inspectors' badges,	4 50		
		<hr/>	43,735 07

*MISCELLANEOUS COLLECTIONS.

		<hr/>	\$1,402,066 80
Return of Inspector's salary (Leroy Wyckoff),	\$56 25		
Court costs from Attorney-General (Pedigree vs. Frost),	16 84		
Reimbursement from express company for lost shipments,	10 00		
Sheriff's fee from J. W. Fleming (Meginnis vs. Shiel),	2 00		
Insurance claim (Inspector Harry G. Burton, for injuries received while engaged on examination work),	60 00		
Returned premiums—official bonds,	13 00		
Sales of old tags,	7 00		
Sales of old tires,	45 67		

*ADJUSTMENT OF FEES.

		<hr/>	\$210 76
Increased registrations—			
80 overweight trucks, at \$10.00,	\$800 00		
58 from second to third class, at \$7.50,	435 00		
1 overweight and additional horse power,	17 50		
1 double transfer and additional horse power,	8 50		
3 from second to third class (half rate), at \$3.75,	11 25		
1 from first to second class, at \$3.00,	3 00		
1 transfer and additional horse power (first to second, half rate),	2 50		
2 double transfers, at \$1.00,	2 00		
		<hr/>	\$1,279 75

COLLECTIONS BY AGENCIES.

Collections made by Agencies during the year and the commissions paid to agents, as compared with collections made in 1915, are as follows:

COMMISSIONER OF MOTOR VEHICLES.

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	1916.		1915.	
	Collections.	Commissions.	Collections.	Commissions.
Asbury Park,	\$39,983 90	\$1,100 00	\$31,201 00	\$900 00
Atlantic City,	48,920 22	1,400 00	41,324 04	1,100 00
Bound Brook,	7,782 92	350 00	9,326 75	150 00
Bridgeton,	16,869 00	500 00	12,007 00	500 00
Camden,	59,538 97	1,900 00	54,385 81	1,600 00
Cape May,	15,740 00	500 00	12,311 25	500 00
Cedar Run,	1,470 00	166 66	.....	.....
Dover,	15,458 25	350 00	9,745 50	250 00
Elizabeth,	31,636 37	900 00	25,152 59	800 00
Englewood,	16,641 25	425 00	13,635 50	350 00
Englishtown,	7,802 34	250 00	5,361 00	150 00
Flemington,	10,425 00	250 00	7,038 25	191 25
Freehold,	10,670 50	250 00	6,804 75	250 00
Hackensack,	38,318 00	910 00	28,044 70	800 00
Hackettstown,	12,158 02	500 00	9,511 99	250 00
Hammonton,	7,076 01	200 00	4,500 00	150 00
Jersey City,	128,173 08	2,100 00	83,781 65	1,778 74
Lakewood,	11,985 80	350 00	8,812 75	250 00
Long Branch,	17,327 08	425 00	11,675 50	350 00
Manasquan,	11,940 00	250 00	5,407 75	150 00
Morristown,	41,008 59	1,100 00	33,888 89	880 40
Mount Holly,	23,069 62	650 00	16,385 26	500 00
Newark,	255,560 44	2,300 00	185,277 62	2,100 00
New Brunswick,	25,541 38	650 00	16,842 50	484 64
Newton,	8,391 99	250 00	6,468 00	250 00
New York,	110,088 92	1,900 00	83,439 11	1,700 00
Passaic,	9,269 75	425 00	.....	.....
Paterson,	89,783 05	1,900 00	71,726 75	1,700 00
Penn's Grove,	7,536 25	200 00	4,466 25	75 00
Perth Amboy,	18,647 47	425 00	11,424 54	400 00
Philadelphia,	16,578 81	350 00	13,511 00	250 00
Phillipsburg,	16,008 50	425 00	12,085 00	350 00
Plainfield,	28,744 74	900 00	16,169 11	240 84
Rahway,	11,046 91	250 00	7,175 00	150 00
Red Bank,	22,531 22	650 00	16,345 91	500 00
Salem,	14,762 50	425 00	10,503 75	250 00
Sea Bright,	7,905 57	250 00	6,501 50	200 00
Somerville,	16,169 50	425 00	12,359 00	350 00
Sussex,	7,975 75	250 00	5,520 50	200 00
Trenton,	80,910 56	1,350 00	82,007 95	1,300 00
Vineland,	13,265 75	250 00	6,683 75	250 00
Woodbury,	23,632 25	650 00	15,692 75	500 00
	<hr/>	<hr/>	<hr/>	<hr/>
	\$1,358,346 23	\$29,051 66	\$1,014,528 21	\$23,100 87
Discontinued agencies,	9 00	12 50	16,907 25	559 75
	<hr/>	<hr/>	<hr/>	<hr/>
	\$1,358,355 23	\$29,064 16	\$1,031,435 46	\$23,660 62

COMMISSIONER OF MOTOR VEHICLES.

REMITTANCES TO THE STATE TREASURER.

Remittances were made to the State Treasurer, monthly, as follows:

<i>Month.</i>	<i>1916.</i> <i>Collections.</i>	<i>Fees.</i>	<i>Balance to State Treasurer.</i>
Balance on hand January 1, 1916,	\$4,111 01		
January,	594,184 41	\$1,279 02	\$140,659 51
February,	133,077 10	1,839 28	456,356 64
March,	57,850 96	2,649 65	131,238 07
April,	115,014 92	2,047 59	55,201 31
May,	109,939 78	2,887 06	112,967 33
June,	113,961 81	2,102 71	107,052 72
July,	89,594 86	2,346 54	111,859 10
August,	76,148 88	2,579 81	87,248 32
September,	38,876 18	2,430 88	73,569 07
October,	37,803 65	2,648 18	36,445 30
November,	22,416 26	2,111 12	35,155 47
December,	13,826 24	4,142 32	20,305 14
	<hr/>	<hr/>	<hr/>
	\$1,406,806 06	\$29,064 16	\$1,368,057 98
Balance on hand December 31, 1916,			9,683 92
			<hr/>
			\$1,377,741 90

The following statement will indicate the business done for a like period in 1915:

<i>Month.</i>	<i>1915.</i> <i>Collections.</i>	<i>Fees.</i>	<i>Balance to State Treasurer.</i>
Balance on hand January 1, 1915,	\$4,578 16		
January,	381,297 00	\$1,245 37	\$76,789 16
February,	140,738 58	1,933 49	307,840 72
March,	90,253 16	2,094 74	138,805 09
April,	93,860 73	2,130 96	88,158 42
May,	71,915 77	1,592 47	91,729 77
June,	79,373 72	2,016 73	70,323 30
July,	71,199 38	1,949 38	77,356 99
August,	51,814 51	2,049 72	69,250 00
September,	33,716 69	1,818 48	49,764 79
October,	22,875 24	1,639 31	31,808 21
November,	18,929 91	2,214 30	21,235 93
December,	7,232 93	3,121 92	16,715 61
	<hr/>	<hr/>	<hr/>
	\$1,067,785 87	\$23,806 87	\$1,039,867 99
Balance on hand December 31, 1915,			4,111 01
			<hr/>
			\$1,043,979 00

COMMISSIONER OF MOTOR VEHICLES.

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RETURNS FROM FINES.

Fines collected for violations of the motor vehicle act amounted to \$41,161.10, this sum showing an increase of \$13,740.25 over the year 1915.

A comparative table follows, showing collections of fines by months for the years 1914, 1915 and 1916:

	FINES.		
	1916.	1915.	1914.
January,	\$1,163 75	\$753 80	\$1,139 45
February,	428 90	836 60	522 30
March,	362 25	1,361 95	432 50
April,	1,029 55	1,864 15	531 60
May,	3,001 85	1,509 55	2,819 75
June,	4,698 15	2,619 35	3,559 15
July,	5,637 25	3,811 65	3,291 95
August,	5,862 85	4,027 00	3,609 95
September,	5,907 15	3,907 75	3,274 03
October,	7,017 60	2,543 30	3,068 00
November,	3,179 00	2,174 10	1,451 20
December,	2,872 80	2,011 65	1,324 50
	<hr/>	<hr/>	<hr/>
	\$41,161 10	\$27,420 85	\$25,025 18

RECAPITULATION.

The following table will show a general recapitulation of increase and percentage of increase in Department work and revenue:

Item.	1915.	1916.	Percent- age of Increase.
Gross receipts,	\$1,063,207 71	\$1,402,695 05	32%
Receipts from auto licenses,	681,254 25	885,009 00	29%
Receipts from motorcycle licenses,	23,232 00	24,418 00	5%
Receipts from drivers' licenses, ..	253,244 00	339,844 00	34%
Receipts from fines,	27,420 85	41,161 10	50%
Number of auto licenses,	78,232	104,341	33%
Number of motorcycle licenses, ..	11,616	12,209	5%
Number of drivers' licenses,	100,126	137,855	37%
Agents' commissions,	\$23,806 87	\$29,064 16	22%
Interest on deposits,	822 86	1,680 44	104%
Manufacturers' licenses,	708	914	29%
Trailers,,	105	321	206%
Trucks over 4,000 lbs.,	3,616	5,073	40%
Transfers,	13,522	20,957	55%

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It will be noted that from all sources the Department collected during 1916 the sum of \$1,402,066.80, an increase of \$338,-859.09 in gross receipts over the preceding year.

The increase of over 100% in interest on deposits is due to the fact that until one year ago, many of the depositories never allowed any interest on our deposits, and the Department, therefore, notified these banks that unless interest was allowed on daily balances, the accounts would be placed elsewhere; and how well this notification was complied with is shown by the interest return above.

AGENTS' FEES.

The compensation paid to agents has been determined by adding the car registrations and the drivers' licenses issued through each agency for the year 1916, as a basis of compensation for the year 1917.

This compensation is in lieu of all overhead office charges, which are defrayed by the agent.

	<i>Items, 1916.</i>	<i>Compensa- tion, 1916.</i>	<i>Compensa- tion, 1917.</i>	<i>Class.</i>	<i>Basis of Rating.</i>
Newark,	48,365	\$2,300	\$2,500	AA	Special.
Jersey City,	22,713	2,100	2,300	AA	Special.
Paterson,	17,306	1,900	2,100	A	15,000 to 20,000
New York,	15,352	1,900	2,100	A	15,000 to 20,000
Camden,	11,872	1,900	1,900	B	10,000 to 15,000
Atlantic City,	9,515	1,400	1,400	C	7,000 to 10,000
Morristown,	8,461	1,100	1,400	C	7,000 to 10,000
Asbury Park,	7,439	1,100	1,400	C	7,000 to 10,000
Hackensack,	6,739	900	1,100	D	6,000 to 7,000
*Passaic,	22,168	425	1,100	D	6,000 to 7,000
Elizabeth,	5,913	900	1,000	E	5,000 to 6,000
Plainfield,	5,426	900	1,000	E	5,000 to 6,000
New Brunswick,	5,237	650	1,000	E	5,000 to 6,000
Woodbury,	4,637	650	900	F	4,000 to 5,000
Mount Holly,	4,356	650	900	F	4,000 to 5,000
Red Bank,	4,208	650	900	F	4,000 to 5,000
Bridgeton,	3,973	500	800	G	3,500 to 4,000
Perth Amboy,	3,569	425	800	G	3,500 to 4,000
Long Branch,	3,486	425	650	H	3,000 to 3,500
Salem,	3,407	425	650	H	3,000 to 3,500
Cape May,	3,323	500	650	H	3,000 to 3,500
Hackettstown,	3,153	500*	650	H	3,000 to 3,500
Somerville,	3,119	425	650	H	3,000 to 3,500
Phillipsburg,	2,981	425	500	I	2,500 to 3,000
Englewood,	2,936	425	500	I	2,500 to 3,000
Dover,	2,878	350	500	I	2,500 to 3,000
Vineland,	2,810	250	500	I	2,500 to 3,000
Lakewood,	2,336	350	425	J	2,000 to 2,500

COMMISSIONER OF MOTOR VEHICLES.

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	<i>Items, 1916.</i>	<i>Compensa- tion, 1916.</i>	<i>Compensa- tion, 1917.</i>	<i>Class.</i>	<i>Basis of Rating.</i>
Manasquan,	2,202	\$250	\$425	J	2,000 to 2,500
Philadelphia,	2,156	350	425	J	2,000 to 2,500
Freehold,	2,122	250	425	J	2,000 to 2,500
Flemington,	2,069	250	425	J	2,000 to 2,500
Rahway,	2,038	250	425	J	2,000 to 2,500
Sussex,	1,798	250	350	K	1,500 to 2,000
Newton,	1,683	250	350	K	1,500 to 2,000
Bound Brook,	1,535	350	350	K	1,500 to 2,000
Penn's Grove,	1,517	200	350	K	1,500 to 2,000
Englishtown,	1,502	250	350	K	1,500 to 2,000
Hammonton,	1,387	200	250	L	1,000 to 1,500
Sea Bright,	1,299	250	250	L	1,000 to 1,500
* Cedar Run,	302	166 66	250	L	1,000 to 1,500
Trenton,	16,029	1,350	1,350	..	Central Office.

Agents' accounts are audited at frequent intervals, and Department funds are transferred to the central depository at Trenton every few days. All funds are deposited in the local banks in the name of the State of New Jersey, and are subject to draft only in the name of the Department. It is a great pleasure to record the fact that not a single dollar of moneys during the past year miscarried in any way whatsoever.

Agents are heavily bonded so that the State is indemnified against loss.

BANK BALANCES.

At the close of business on December 30, 1916, the following balances were in the hands of banks to the credit of the Motor Vehicle Department, these balances representing the amount of business audited by the Department account of 1917 registrations:

Asbury Park,	\$2,702 44
Atlantic City,	13,927 60
Bound Brook, .....	.....
Bridgeton,	3,799 00
Camden,	15,823 45
Cape May,	942 00
Cedar Run,	1,550 00
Dover,	1,208 50
Elizabeth,	9,959 94

* The Passaic and Cedar Run Agencies were established February 28th and March 1st, 1916, respectively, after the rush of 1916 business was over. However, their receipts for 1917, as this report closes, justify the ratings which have been given them above.

Englewood,	\$2,656 50
Englishtown,	2,694 50
Flemington,	998 00
Freehold,	1,460 00
Hackensack,	7,793 25
Hackettstown,	1,756 00
Hammonton,	1,808 50
Jersey City,	16,253 52
Lakewood,	2,748 50
Long Branch,	2,229 50
Manasquan, .....	.... ..
Morristown,	7,049 61
Mount Holly,	5,334 50
Newark,	29,209 90
New Brunswick, .....	.... ..
Newton,	811 50
New York,	14,577 75
Passaic,	8,464 75
Paterson,	6,555 00
Penn's Grove,	457 00
Perth Amboy,	3,764 00
Philadelphia,	2,246 50
Phillipsburg,	3,315 17
Plainfield,	3,308 20
Rahway,	1,695 00
Red Bank,	2,637 50
Salem,	3,333 25
Sea Bright,	571 50
Somerville,	2,767 00
Sussex,	1,052 00
Trenton,	8,764 75
Vineland,	3,110 50
Woodbury,	9,319 00

\$208,656 06

GROSS RECEIPTS OF DEPARTMENT BY YEARS.

The gross receipts of the Department by years follows:

1906,	\$67,963 00
1907,	92,763 25
1908,	188,742 94
1909,	247,424 21
1910,	322,649 66
1911,	413,786 27
1912,	496 653 35
1913,	661,084 40
1914,	814,535 30
1915,	1,063,207 71
1916,	1,402,695 05

COMMISSIONER OF MOTOR VEHICLES.

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COMPARISON OF LICENSES ISSUED DURING THE PAST THREE YEARS.

The following table shows the number of licenses issued by months as compared with 1914 and 1915:

	Automobiles			Motorcycles			1st Class Drivers			2d Class Drivers			Mfg.			
	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.	1914.	1915.	1916.	1916.
January, ...	18,615	26,839	46,055	1,314	1,633	2,222	15,559	27,036	37,513	8,375	12,458	15,304	225	269	540	
February, ..	11,593	12,088	9,957	1,285	1,445	1,413	6,901	5,432	10,841	3,049	2,073	3,235	238	185	111	
March,	3,014	7,327	4,118	672	2,086	902	1,853	5,120	3,845	802	1,668	1,209	37	75	51	
April,	6,264	6,841	8,940	1,918	1,686	2,244	4,401	5,765	7,895	1,747	1,889	2,062	41	44	55	
May,	5,571	5,185	7,894	1,631	1,321	1,792	4,751	5,237	8,426	1,952	1,502	2,167	30	22	36	
June,	4,510	5,132	7,555	1,184	1,202	1,232	4,215	5,858	9,004	1,927	2,202	2,662	19	33	39	
July,	3,530	4,565	5,707	850	804	826	3,476	5,686	7,233	1,618	1,813	2,076	15	24	21	
August,	2,072	3,208	4,800	472	613	657	2,612	4,251	7,189	870	1,167	1,502	10	20	30	
September, .	1,966	2,804	3,501	351	411	436	1,923	3,563	4,793	459	790	649	9	18	19	
October, ...	1,608	2,068	2,779	215	245	277	1,440	2,709	4,505	321	482	613	6	8	6	
November, ..	1,045	1,682	1,991	113	161	146	1,294	2,267	2,915	228	366	335	4	10	4	
December, ...	460	493	1,044	24	27	62	470	696	1,569	70	86	163	...	...	2	
	60,248	78,232	104,341	8,419	11,616	12,209	38,383	73,630	105,788	16,963	26,496	32,067	634	708	914	

APPROPRIATIONS.

The appropriations, annual and supplemental, for the year 1916 were as follows:

ANNUAL.

For salary for the Commissioner of Motor Vehicles,	\$1,500
For salary for the Chief Inspector,	1,800
For compensation for inspectors,	28,350
For expenses and equipment of inspectors,	17,000
For compensation for clerical services,	9,750
For postage, expressage, and other incidental expenses,	5,500
For blanks and stationery,	7,500
For the purchase and packing of identification markers and dies for use in connection with the same,	27,300
For refunds,	200
	<hr/>
	\$98,900

SUPPLEMENTAL.

For additional allowance for compensation for inspectors,	\$4,725
For additional allowance for expenses and equipment of inspectors,	2,300
For additional allowance for compensation for clerical services, ...	500
For additional allowance for postage, expressage, and other in- cidental expenses,	500
For additional allowance for blanks and stationery,	500
For additional allowance for reimbursement of applicants who have made errors in the rating of their machines,	100
For the purchase of automobiles,	5,000
For accident liability insurance,	500
	<hr/>
	\$14,125

The total of the above appropriations amounts to \$113,025, of which sum, \$93,388.74 was expended, leaving a balance of \$19,636.26. A saving alone of \$6,504.76 was effected in the purchase of markers, \$3,855.29 account expenses and equipment of inspectors, and \$2,772.17 in postage and expressage, this latter saving being due principally to the fact that the manufacturers of markers were required to make shipments direct to agents instead of to Trenton as heretofore.

It will thus be seen that the total expenditures of the Department for the year amounted to \$122,452.90, made up as follows:

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Appropriations,	\$93,388 74
Agents' commissions,	29,064 16

\$122,452 90

which sum is equivalent to 8¼% on the gross receipts of the Department.

DEPARTMENT WORK WITH REFERENCE TO ENFORCEMENT OF MOTOR VEHICLE AND TRAFFIC ACTS.

Hearings Before Commissioner.

1,365 cases were heard before the Commissioner sitting as a magistrate. This is an increase of 223 cases over last year. 251 drivers' licenses were revoked; 164 names were placed on the black list to be refused licenses; 52 licenses were suspended; 26 reciprocity privileges were suspended; 54 car registrations were revoked, 13 motorcycle registrations were revoked and 62 licenses were restored.

Fines amounting to \$4,291.75 were imposed and collected by the Commissioner, which sum is an increase of \$2,033.40 over 1915.

The number of hearings by months were:

January,	31
February,	46
March,	58
April,	73
May,	125
June,	169
July,	198
August,	216
September,	171
October,	145
November,	72
December,	61

1,365

Realizing the injustice of requiring residents of North Jersey to make answer to summons by coming to Trenton, the Commissioner early in the year established a weekly court in the cities of Newark, Paterson and Passaic, suitable accommodations being provided by the authorities of the cities named.

These hearings have been largely attended and the publicity incident to their holding has undoubtedly had a deterrent effect

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on those motorists who heretofore had little regard for law enforcement.

WORK OF INSPECTORS.

During the year, 796 cases were referred to the inspectors for investigation and report.

The total number of cases reported to the Department numbered 10,167, of which 8,802 were minor in character and adjusted without the necessity of a hearing.

The inspectors adjusted during their work in the field 10,392 cases of minor violations, made 2,138 arrests which were heard before local magistrates and served 1,405 summons.

A summary of the above follows:

Cars with headlights not properly dimmed,	4,738
Cars not equipped with mirrors,	507
Cars with swinging numbers,	43
Drivers' licenses increased from first to second class,	104
New registrations and licenses (licenses),	932
New registrations and licenses (registrations),	1,616
Speeding and reckless driving,	463

EXAMINATIONS FOR DRIVERS' LICENSES.

A total of 54,605 applicants were examined for drivers' licenses, of which number 7,164 were rejected as incompetent. The following comparisons will be interesting as showing the astonishing increase in new drivers in New Jersey during the past two years:

	1916		1915	
	Passed.	Rejected.	Passed.	Rejected.
January,	1,704	176	943	73
February,	1,092	201	789	96
March,	1,610	324	2,277	277
April,	3,588	657	3,053	411
May,	6,060	1,072	4,700	628
June,	6,909	920	5,766	483
July,	6,774	770	5,066	425
August,	6,675	905	4,576	410
September,	4,836	744	3,612	307
October,	4,289	784	2,687	338
November,	2,608	465	2,095	223
December,	1,296	192	1,058	111
	47,441	7,210	36,622	3,782
Total, 1916, 54,651.	Total, 1915, 40,404.			

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	1916		1915	
	Passed.	Rejected.	Passed.	Rejected.
Newark,	13,514	1,927	11,336	1,264
Asbury Park,	2,361	330	3,849	345
Paterson,	3,430	705	3,964	507
Morristown,	2,917	372	2,608	272
Jersey City,	5,669	863	2,145	212
Trenton,	4,219	685	3,565	397
Hackettstown,	1,373	68	1,338	96
Cape May Court House,	706	65	685	36
Sussex,	390	29	267	29
Camden,	2,921	513	3,155	287
Atlantic City,	2,236	423	2,191	224
Bridgeton,	1,111	231	833	54
Salem,	904	133	686	59
New Brunswick,	1,770	336	.....	...
Long Branch,	1,738	205	.....	...
Toms River,	239	25	.....	...
Passaic,	1,885	291	.....	...
Englewood,	58	9	.....	...
	47,441	7,210	36,622	3,782
Total, 1916, 54,651.	Total, 1915, 40,404.			

It is generally admitted by those States which do not require an examination for all automobile drivers that the law in New Jersey covering this phase is the best of any that obtains elsewhere.

Aside from the personal contact with the inspection force and the applicant, the fact that the applicant must have a knowledge of the fundamentals of the motor vehicle and traffic acts is of tremendous value in equipping the applicant, so that ignorance of the law can no longer be advanced as an excuse for accidents.

For the purpose of apprehending flagrant violations of the reciprocity law, the inspectors were detailed from time to time at the ferries and at the principal coast resorts, and the following sums were collected by the inspectors as the result of this detail:

Inspector Boutilier—

\$7,941.50; 600 registrations; 267 drivers' licenses.

Inspector Gilbert—

\$5,074.50; 278 registrations; 169 drivers' licenses.

Inspector Lovett—

\$2,578.00; 230 registrations; 7 drivers' licenses.

Inspector Pedigree—

\$2,628.75; 180 registrations; 194 drivers' licenses.

Inspector Baldwin—

\$1,462.50; 82 registrations; 64 drivers' licenses.

Inspector Martens—

\$854.75; 39 registrations; 29 drivers' licenses.

Inspector Shedd—

\$275.00; 11 truck registrations.

Inspector Mines—

\$178.50; 13 truck registrations; 10 drivers' licenses.

Inspector Stagg—

\$86.25; 5 truck registrations.

Inspector Grant—

\$528.50; 37 registrations; 28 drivers' licenses.

Inspector Teel—

\$2,052.50; 147 registrations; 164 drivers' licenses.

The grand total for this work amounts to \$23,660.75.

To the above may safely be added the sum of one hundred thousand dollars (\$100,000) additional, as a conservative estimate of the amount received by the Department for registration and drivers' licenses directly traceable to the activities of the inspectors in the apprehension of reciprocity violations.

SPECIAL ACCIDENT REPORTS.

As the result of passage of Chapter 163, P. L. 1916, requiring that all accidents involving personal injury or property damage to an amount exceeding ten dollars, be reported to the Department, six hundred and forty such reports were received and referred to the inspectors for investigation.

Undoubtedly, many of these reports would never have reached the Department had the Act quoted not been in operation, and the value of such reports is that it enables the Department to keep an accurate card index of the competency of all licensed drivers, enabling the Department to tell at a glance whether such driver has ever been embroiled in more than one accident.

COMMISSIONER OF MOTOR VEHICLES.

17

INVENTORY, DECEMBER 30, 1916.

<i>Date of Purchase.</i>	<i>Year and Model.</i>	<i>Make.</i>	<i>Type.</i>
May 2, 1914,	One 1913, 35 T,	Mercer,	Raceabout.
May 13, 1915,	One 1914, 35 T,	Mercer,	Raceabout.
May 13, 1915,	One 1915, C. 36,	Buick,	Runabout.
May 13, 1915,	One 1915, C. 36,	Buick,	Runabout.
May 13, 1915,	One 1915, C. 36,	Buick,	Runabout.
May 10, 1916,	One 1916, 22-72,	Mercer,	Raceabout.
April 22, 1916,	One 1916,	Dodge,	Touring.
April 22, 1916,	One 1916,	Dodge,	Runabout.
April 22, 1916,	One 1916,	Dodge,	Runabout.
May 22, 1916,	One 1916, T,	Ford,	Runabout.
May 22, 1916,	One 1916, T,	Ford,	Runabout.

1916, Mercer Raceabout (Grant),	\$1,500 00
1914, Mercer Raceabout (Havens),	700 00
1913, Mercer Raceabout, (Shedd),	500 00
1913, Buick Runabout, (Shinn),	375 00
1913, Buick Runabout (Sawyer),	375 00
1913, Buick Runabout (Vey),	375 00
1915, Dodge Runabout (Pedigree),	400 00
1915, Dodge Runabout (Mines),	400 00
1915, Dodge Touring (Johnson),	400 00
1915, Ford Runabout (Martens),	225 00
1915, Ford Runabout (Lovett),	225 00

\$5,475 00

GENERAL.

During the year 1916 two hundred and fifteen persons were killed in New Jersey by automobiles as compared with two hundred and forty-one persons killed by autos in this State in 1915, showing a decrease for the year of twenty-six persons, New Jersey being the only Eastern State to thus reduce the number of automobile fatalities. Referring to this decrease, the National Highway Protective Society in its Annual Report, released January 1st, 1917, said: "Stricter regulation and the licensing of every operator is responsible for the decrease in deaths and accidents in New Jersey."

DISPOSITION OF FINES.

The Department expresses the hope that the Legislature will not permit the emasculation of the Motor Vehicle Act so that fines recovered for penalties of said Act will revert to the municipalities in which the violations were noted instead of the State as at present, for past experience offers the most convincing proof that if the municipalities are permitted to retain the fines the State will soon be overrun with speed traps, and instead of an orderly system of regulation, persecution of the motoring public will be the vogue and the freedom with which our highways are now used by tourists will no longer be the rule.

In the neighboring State of Pennsylvania speed traps in countless number are now maintained and little opportunity is afforded the traveling public to properly defend the alleged charges of excessive speeding frequently brought against them. The practice of many justices in Pennsylvania is to simply take the registration number of visiting cars, and then a week or two perhaps after the visitor has returned to his home he receives a notice commanding him to appear before the justice on a certain day, or in the event of his inability to appear, to send a check for \$13.65, upon receipt of which complaint will be disposed of. Very often the motorist whose home is situate one hundred or more miles from the scene of the alleged violation will meet the demands of the justice by sending a check rather than to be further burdened with the matter. If the law in Pennsylvania would require that all fines be forwarded to the State Treasurer and the fees which a magistrate was permitted to charge were written in the statute, as is the case in New Jersey, no such petty scheme of levying tribute as has been outlined above would be possible.

CO-OPERATION BY LOCAL AUTHORITIES.

Better co-operation and support on the part of local officials with respect to the enforcement of the Motor Vehicle and Traffic Act is noticeable although there is much room for improvement,

and until those charged with the enforcement of the law awaken to the realization that reckless driving and the operation of motor vehicles by intoxicated drivers will no longer be tolerated in New Jersey, shocking accidents will continue to occur. Numerous citations establish that intoxication may be proved by the observation of witnesses and that expert testimony is not necessary, and it should not be a difficult matter for any magistrate to determine from the evidence whether or not the driver was intoxicated, and if adjudged guilty the penalty provided in Chapter 67, P. L. 1913, of a minimum sentence of thirty days to six months in jail, should unhesitatingly be invoked. The imposition of a drastic penalty, coupled with the loss of the driver's license, must be brought home forcibly to the motoring public if the minimum of fatalities is to be maintained as the congestion in traffic, due to the rapidly growing number of automobiles, increases.

HOME RULE AS IT RELATES TO VEHICULAR TRAFFIC.

The attention of the Legislature is especially directed to the danger of giving to the municipalities of the State, under any Home Rule Legislation, the right to regulate vehicular traffic by fixing the speed of vehicles and to adopt rules for the guidance of automobile and team drivers other than the rights now accorded to municipalities by the Traffic Act. The argument that a municipality should have the right to govern itself is sound doctrine, but it should never extend over so wide a range as to permit every municipality in the State to pass ordinances incompatible with one another as dealing with vehicular traffic. If the right of the State to regulate this matter uniformly is taken away, every motorist and team driver will have to be a traveling encyclopedia, for what is lawful in one place will be unlawful in another. The successful operation of our present Traffic Act lies in the fact that it automatically repealed all local ordinances, rules and regulations dealing with vehicular traffic, and that a driver needs but to acquaint himself with the provisions of the act to know what is lawful and what is unlawful in New Jersey.

RELATIONS WITH CONTIGUOUS STATES.

Cordial relations have been maintained with the States of New York, Pennsylvania, Delaware and Maryland, and at a conference, called by Governor Miller, of Delaware, in December last, an arrangement was entered into whereby the State of Delaware agrees to repeal during the next few months the obnoxious feature of its reciprocity law which requires that all commercial trucks be registered in Delaware immediately upon entering that State.

It is worthy of note that the States of Pennsylvania and New York are to make an effort to enact a law requiring that all motor vehicle operators be licensed. To differentiate between the automobile driver, whose very livelihood is dependent upon the competency with which he operates an automobile and the car owner, whose only claim for distinction is that he owns an automobile, is certainly discriminatory, and if Pennsylvania and New York will write upon the statute books legislation making it mandatory for all car drivers to first submit to an examination before a license is issued, such laws will be of material assistance to the New Jersey authorities in determining whether drivers from the two States mentioned are operating legally.

INDEMNITY FOR AUTOMOBILE ACCIDENTS,

Suggestion has been made to the Department that a thorough investigation be made of the reliability and responsibility of every owner of a car applying for a registration, to the end that if such owner cannot show sufficient personal financial responsibility, a bond or insurance policy should be filed with the Department to cover the owner's liability for personal injury and property damage occasioned by the car.

The justice of compensating the workingman for injuries received was recognized in this State by the enactment of a Workmen's Compensation Law, and considerable merit, therefore, seems to attach to the proposition of protecting the public against the chances of injury at the hands of a reckless auto-

mobilitist by providing indemnity for injury or death. However, to require a New Jersey motorist to file a bond or insurance policy with the Department at the time of the issuance of the registration, while no such exaction obtains in the other States, would fall far short of affording the protection desired, and so the Department refrains from making any specific recommendation at this time, preferring to await concerted action on the part of those States contiguous to this State.

REGULATION OF COMMERCIAL TRUCKS.

By virtue of the authority vested in the Commissioner of Motor Vehicles, P. L. 1915, Chapter 148, it became necessary several months ago to take up the question of regulating the width, height, tires and equipment with safety devices of any commercial vehicle of over four thousand pounds in weight with a view for its safety for use on the roads.

The disintegration of our highways as a result of this heavy hauling, and numerous protests from the traveling public because of the menacing manner in which trucks were being operated, prompted the appointment of a committee of five engineers who have spent considerable time in assisting the Commissioner to solve the problem, and appended to this report is the report of the Engineering Committee whose recommendations the Department unqualifiedly endorses and urges the enactment into law of the bills which will shortly be introduced covering the Engineering Committee's findings. From every State in the Union have come requests for copies of the report on this subject, clearly indicating the widespread interest which is being taken in the work of the New Jersey authorities in the regulation of commercial trucks.

In urging an increase in registration fees for commercial trucks the Department has no hesitancy in stating its belief that the schedule of increases as proposed by the Engineering Committee is absolutely fair and equitable, and that some increase must obtain if our highways are to be kept in condition to meet the heavy hauling in which the motor vehicle has now adapted itself.

It will be noted that the report exempts commercial vehicles equipped with pneumatic tires.

NEW LEGISLATION.

Aside from the preceding recommendations, anent the registration and regulation of commercial trucks, the Department does not believe that material changes should be made in either the Motor Vehicle or Traffic Act, but rather the Legislature should see to it that no radical amendments are accepted, for it is generally recognized that the Laws of New Jersey dealing with vehicular traffic are the best of any State, and an orderly enforcement is all that is necessary to safeguard the users of our highways.

The Department, therefore, urges only the following amendments:

That reciprocity be extended to embrace the Dominion of Canada and Province of Quebec;

That the use of registration numbers for the new year be allowed on the last day of the year preceding;

That the use of spot lights, so-called, for driving purposes, be prohibited;

That the term "Motorcycle" be more clearly defined so as to include the "Auto-ped";

That only two white lights be allowed on the front of a motor vehicle; and

That the salaries of the inspection force be increased, as follows:

Chief Inspector from \$1,800 to \$2,000 per annum,

Deputy Chief Inspector from \$1,500 to \$1,800 per annum,

Inspectors from \$1,350 to \$1,600 per annum.

CONCLUSION.

It is gratifying to make mention of the assistance rendered to the Department by the police departments of the larger cities where requests for local officers to assist the Department Inspectors have been cheerfully complied with.

The various agencies have been well conducted and the local representatives of the Department have been conscientious in the discharge of their duties. To the inspection force especially great credit is due for the unselfish manner in which they have discharged their duties. Frequently they have been called upon to work twenty hours a day and in all kinds of weather have unflinchingly met every demand made upon them by the motor-ing public. They have served the State well and the Department is pleased to urge an increase in their salaries in recognition of this service.

Respectfully submitted,

WM. L. DILL,
Commissioner of Motor Vehicles.

ADDENDA.

**Report of the Special Committee of County Engineers Appointed
by the Commissioner of Motor Vehicles to Consider
the Question of Regulation of Commercial
Motor Vehicle Traffic.**

TRENTON, NEW JERSEY, December 12, 1916.

*Honorable William L. Dill,
Commissioner of Motor Vehicles, State of New Jersey,
Trenton, New Jersey.*

DEAR SIR—The Special Committee of County Engineers appointed by you last May, to take up the question of regulation of commercial motor vehicle traffic on the highways of the State, have reached their final conclusions after having held ten meetings and two open hearings.

At the various meetings of the Committee the question has been considered in every phase suggested by yourself and the members of the Committee, and from the suggestions and criticisms received in the open meetings and from a large number of letters received from manufacturers of trucks, tire companies, operators and from interested parties. We have also had reports from several State Highway Departments concerning the necessity for regulations of this character and have further received many valuable suggestions from periodicals and engineering papers.

The Committee have considered said regulations from the viewpoint of the road builder and also view the question as to the users of the highways, and has endeavored to reach a conclusion which would be fair, just and equitable to all parties.

Throughout the entire study of this question there has existed the closest harmony, and each member of the Committee has added substantially to the conclusions arrived at herein.

The report of your Committee becomes therefore a composite report of the thought and suggestions of the various members of the Committee and is unanimously recommended to you.

In closing their work, the Committee desires to express their appreciation for the opportunity which you have given them to work with you in the formulation of these regulations.

Respectfully submitted,

THOMAS J. WASSER, *Chairman*,
JOHN J. ALBERTSON,
ALVIN B. FOX,
GARWOOD FERGUSON,
FREDERICK A. REIMER, *Secretary*,
Special Committee.

**Report of Special Committee for Formulation of Regulations
Governing use of Commercial Motor Vehicles and
Motor-Drawn Vehicles on the Highways
of New Jersey.**

DEFINITIONS.

COMMERCIAL MOTOR VEHICLE.

A commercial motor vehicle, as referred to in this report, shall include every type of motor-driven vehicle used for commercial purposes on the highways, excepting such vehicles as run only upon rails or tracks.

MOTOR-DRAWN VEHICLE.

A motor-drawn vehicle, as referred to in this report, shall include trailers, semi-trailers or any other type of vehicle drawn by a motor-driven vehicle.

TRAILERS.

Trailers referred to in this report are vehicles of more than two wheels, without motor power.

SEMI-TRAILERS.

Semi-trailers referred to in this report are two-wheel vehicles without motor power.

PNEUMATIC TIRES.

A pneumatic tire, as referred to in this report, is a rubber tire in which the air chamber has a cross section area of at least fifty per cent. of the total cross section area of the tire and air chamber combined, and which depends upon the sustaining power of compressed air therein contained to support the load.

SOLID RUBBER TIRES.

All other tires, as referred to in this report, shall be classed as solid rubber tires.

1.

All commercial motor vehicles equipped on all wheels with pneumatic tires shall pay the same registration fee as now provided for pleasure cars in subdivision 3, section 16-B, of the Motor Vehicle Act, and in lieu of sealed governor or other mechanical device shall be operated in accordance with section 23 of said act.

Vehicles of this class shall not be required to have attached to chassis the metal plate as hereinafter provided for on other vehicles.

2.

No commercial motor vehicle or motor-drawn vehicle shall be more than 96 inches in width, outside measurements; in extreme cases the Commissioner of Motor Vehicles shall be privileged to issue special permits for the operation of commercial motor vehicles with a width of load over 96 inches where the weight of the load is not a factor.

Such special permits may be granted by the Commissioner of Motor Vehicles gratuitously, and for such period of time as in the judgment of the Commissioner may be necessary to meet the needs of the applicant, but in no event shall such special permit exceed the period of time for which vehicle is registered.

3.

The height of all commercial motor vehicles and motor-drawn vehicles, including load, shall be limited to 12 feet 2 inches.

4.

The extreme over-all length of commercial motor vehicles shall not exceed 26 feet 6 inches.

5.

All commercial motor vehicles or motor-drawn vehicles shall be equipped with rubber tires.

No commercial motor vehicle or motor-drawn vehicle shall be equipped with metal tires that may be in contact with the surface of the road, nor shall any such vehicle be equipped with any tires which may have a partial contact of the metal with the surface of the road.

6.

No commercial motor vehicle or motor-drawn vehicle shall be equipped with any tire covering of metal, with lugs or hobs, or other sharp devices, which would be in contact with the surface of the road; chains or other devices acceptable to the Commissioner of Motor Vehicles may be used in accordance with section 6 of the Motor Vehicle Act.

Traction machines and agricultural machinery, the equipment of which does not comply with this report, may be licensed by the Commissioner of Motor Vehicles to travel upon the highways in cases where coverings of wood or other substance are attached to the wheels in such manner as to present a smooth surface, and in accordance with regulations and fee to be fixed by the Commissioner of Motor Vehicles.

The speed of such vehicles shall not exceed the rate of four miles per hour.

7.

All commercial motor vehicles not equipped on all wheels with pneumatic tires shall be equipped with a sealed governor, or other automatic control, by which the speed shall be regulated so as not to exceed the schedule of speeds contained herein.

8.

Every commercial motor vehicle shall be lighted in accordance with section 4 of the Motor Vehicle Act, and no center searchlight is to be allowed on any such vehicle.

9.

Not more than one trailer or semi-trailer shall be allowed to be drawn by any commercial motor vehicle at the same time.

10.

The commercial size of tires used on all commercial motor vehicles or motor-drawn vehicles shall be determined on the maximum width of rubber, and in no case shall the width of bearing surface unloaded be less than two-thirds of the commercial size.

11.

Whenever any tire or wheel on any commercial motor vehicle or motor-drawn vehicle is damaged so as to allow the metal to come in contact with the surface of the road, in every such instance the vehicle shall immediately stop and not proceed until proper repairs have been made.

A penalty not exceeding five hundred dollars shall be imposed by the Commissioner of Motor Vehicles for violation of this section.

12.

All commercial motor vehicles not equipped on all wheels with pneumatic tires shall have on the left-hand side of the chassis, in plain view, a metal plate giving the following information:

Maker's name,
 Number,
 Model,
 Motor number,
 Weight of vehicle,pounds,
 Allowable load,pounds,
 Gross weight,pounds,
 Maximum speed,miles per hour.

An affidavit at the time of registration will be required from the licensee that the gross weight in accordance with said plate shall not be exceeded.

13.

No commercial motor vehicle shall be used as a pleasure vehicle without securing a special permit for every such occasion from the Commissioner of Motor Vehicles or his authorized agent. No charge will be made for such permit.

14.

No registration will be issued for any commercial motor vehicle, tractor, trailer, or semi-trailer, equipped with tires smaller than tires as required by schedule contained herein.

15.

Load for each rear wheel of commercial motor vehicles and motor-drawn vehicles.

Not more than one-third of the gross weight of vehicle and allowable load combined, as shown on the chassis plate, shall exceed the limits of the schedule of the respective diameter of wheel, size of tire, and speed in miles per hour, as shown in the schedule herein contained.

16.

Load for front wheel or wheels of commercial motor vehicles and motor-drawn vehicles.

The front axle shall carry the balance of the gross weight of vehicle and allowable load combined, as shown on the chassis plate, and must be within the limits of the schedule of the respective diameter of wheel and size of tire, as shown in the schedule herein contained.

17.

All commercial motor vehicles or motor-drawn vehicles carrying loads extending beyond the outside dimensions of said vehicles shall have displayed at the outside extremities of load red flags by day, which shall be not less than twelve inches square, and red lights by night, and they shall be so hung as to present a full view to drivers of approaching vehicles. Such red lights shall be in addition to the red light now provided for in section 4 of the Motor Vehicle Act.

18.

The authorities having control of the several bridges on the highways and over the highways in the State shall place and maintain signs in a conspicuous place on each bridge, showing the clearance where the headroom is less than 12 feet 6 inches.

19.

The authorities having control of the bridges in the counties of this State shall place and maintain in conspicuous places on each bridge signs stating the gross weight which said bridges will carry, and all owners of commercial motor vehicles or motor-drawn vehicles will be responsible for any damage done to any bridge where the gross weight carried by such commercial motor vehicle or motor-drawn vehicle exceeds the carrying capacity of bridge.

20.

All motor vehicle inspectors shall be authorized to make such tests as in their judgment may be necessary for the purpose of determining the gross weight, size of tires and speed in miles per hour, of all commercial motor vehicles and motor-drawn vehicles operated on the highways of this State and licensed in accordance with the provisions contained herein.

21.

All trailers or semi-trailers shall be licensed on their carrying capacity; where the carrying capacity in pounds is equivalent to the gross weight of load in schedule for license fees, the charge shall be the same.

Tractors are motor power vehicles without bodies, and shall be licensed on their gross operating weight at the price fixed in the schedule for gross weight. Size of wheel and tire and speed shall conform to the schedule contained herein.

22.

All commercial motor vehicles and motor-drawn vehicles which do not in every particular conform to the requirements herein contained, and which have been licensed in New Jersey prior to

the approval of the act embodying the recommendations of this report, shall be permitted to operate within this State from January 1st, 1917, to December 31, 1918, under the following conditions:

a. Where the dimensions of any such vehicle exceeds the dimensions required herein, said vehicle will not be compelled to reduce dimensions, but in no case shall the dimensions be increased.

b. Vehicles equipped with steel tires will not be required to change said tires to comply with the requirements herein contained.

c. Vehicles not equipped with a sealed governor will not be required to install same, but no vehicle will be permitted to remove sealed governor where it is now part of equipment of vehicle.

d. License fees for all vehicles referred to in this section shall be within the requirements of wheel loads in sections 15 and 16 and schedule of license fees.

GROSS WHEEL LOAD IN POUNDS AND MAXIMUM SPEED IN MILES PER HOUR FOR
COMMERCIAL MOTOR AND MOTOR-DRAWN VEHICLES EQUIPPED WITH
TIRES OF A GIVEN SIZE AND DIAMETER.

<i>Size of Tires. (Single.)</i>	<i>Diameter of Wheel and Carrying Capacity.</i>						<i>Speed miles per hour for rear Wheels.</i>
	32"	34"	36"	38"	40"	42"	
2 inches,	585	595	625	660	690	720	20
2½ inches,	840	890	940	990	1,040	1,090	20
3 inches,	1,125	1,190	1,250	1,315	1,375	1,440	20
3½ inches,	1,415	1,490	1,565	1,640	1,715	1,790	18
4 inches,	1,690	1,780	1,875	1,970	2,065	2,155	16
5 inches,	2,250	2,375	2,500	2,625	2,750	2,875	14
6 inches,	2,815	2,970	3,125	3,285	3,440	3,595	12
7 inches,	3,375	3,565	3,750	3,940	4,125	4,315	10
<i>(Double.)</i>							
2 inches,	1,125	1,188	1,250	1,312	1,375	1,438	18
2½ inches,	1,675	1,775	1,875	1,975	2,075	2,175	18
3 inches,	2,250	2,375	2,500	2,625	2,750	2,875	16
3½ inches,	2,825	2,975	3,125	3,275	3,425	3,575	14
4 inches,	3,375	3,560	3,750	3,940	4,125	4,310	13
5 inches,	4,500	4,750	5,000	5,250	5,500	5,750	12
6 inches,	5,625	5,940	6,250	6,565	6,875	7,190	10
7 inches,	6,750	7,125	7,500	7,875	8,250	8,625	10

COMMISSIONER OF MOTOR VEHICLES.

SCHEDULE SHOWING ANNUAL FEE AND FEE IN SEPTEMBER BASED ON
GROSS WEIGHT.

<i>Gross Weight of C. M. V. and Carrying Capacity, Pounds.</i>	<i>Annual Fee.</i>	<i>Fee in September.</i>
4,000 or less,	\$15 00	\$7 50
4,000 to 5,000,	17 00	8 50
5,001 to 6,000,	19 00	9 50
6,001 to 7,000,	21 00	10 50
7,001 to 8,000,	23 00	11 50
8,001 to 9,000,	25 00	12 50
9,001 to 10,000,	27 00	13 50
10,001 to 11,000,	29 00	14 50
11,001 to 12,000,	31 00	15 50
12,001 to 13,000,	33 00	16 50
13,001 to 14,000,	35 00	17 50
14,001 to 15,000,	37 00	18 50
15,001 to 16,000,	39 00	19 50
16,001 to 17,000,	41 00	20 50
17,001 to 18,000,	43 00	21 50
18,001 to 19,000,	45 00	22 50
19,001 to 20,000,	47 00	23 50
20,001 to 21,000,	49 00	24 50
21,001 to 22,000,	51 00	25 50
22,001 to 23,000,	53 00	26 50
23,001 to 24,000,	55 00	27 50
24,001 to 25,000,	57 00	28 50
25,001 to 25,875,	59 00	29 50

(Signed), THOMAS J. WASSER,

Chairman,

GARWOOD FERGUSON,

JOHN J. ALBERTSON,

ALVIN B. FOX,

FRED. A. REIMER,

Secretary.

Document No. 50

REPORT
OF THE
QUARTERMASTER GENERAL
OF THE
STATE OF NEW JERSEY
1916

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QUARTERMASTER GENERAL
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STATE OF NEW JERSEY
1916

TRENTON, N. J.
MACCRELLISH & QUIGLEY Co., State Printers

1917

Report of the Quartermaster General.

To the Governor:

The report of the operations of this department for fiscal year ended October 31, 1916, is herewith submitted. Under Section 67 of an act entitled "An act for making further and more effectual provisions for the National defense and for other purposes," approved June 3, 1916, the Governor is required to appoint, designate or detail, subject to the approval of the Secretary of War, an officer to be regarded as property and disbursing officer for the United States of the National Guard of the State. This officer will be paid for his services, and shall receipt and account for all funds and property belonging to the United States in possession of the National Guard, and shall make such returns and reports concerning the same as may be required by the Secretary of War. This action will relieve the Governor of the State, after his accounts for the present year have been audited and settled by the War Department, from further responsibility for military property heretofore issued for the use of the organized militia of this State. Lieutenant Colonel David S. Hill, of this department, has at my request been designated by the Governor for the position of property and disbursing officer under the National Defense Act, and his appointment and bond have been approved by the War Department. All property issued to the State troops mobilized on the Mexican border has been receipted for to the Governor, and credit taken therefor upon his property accounts to be filed with the War Department. The Federal property in possession of the organizations which were not called out for mobilization, together with that at the State Arsenal, State Camp grounds and remaining in the armories of the organizations called to the border, has been turned over to the U. S. property and disbursing officer. Any deficiencies remaining after such transfers will

4 QUARTERMASTER GENERAL'S REPORT.

be duly adjusted and the accounts of the Governor finally settled with the War Department with as little delay as practicable.

The small amount of military property belonging to the State is of little value, being unserviceable, or of obsolete pattern, and will be disposed of by survey, condemnation and sale pursuant to law.

EXPENDITURES.

With the exception of the attendance of the commissioned and uncommissioned officers of the First Squadron Cavalry at the camp of instruction at Fort Myer, Virginia, the field exercises for the organizations of the National Guard as indicated in General Orders No. 9, A. G. O., May 9, 1916, were suddenly terminated by the call of the President for the organized militia for duty on the Mexican border in the service of the United States. The moneys appropriated by the Legislature for the annual encampment were applied to the payment in part of the expenses of the mobilization of the 1st, 4th, and 5th Infantries, 1st Squadron Cavalry, Signal Corps Company, and First Field Hospital and Ambulance Company at Sea Girt under General Orders No. 12, dated June 18, 1916, preparatory to their departure to the border. The amount expended during the fiscal year ended October 31, 1916, does not represent the actual or entire expense incurred on the part of the State for mobilization of the organizations named above and the subsequent encampment of the 2d and 3d Infantries, National Guard, as many bills aggregating nearly \$20,000 have not been received and consequently cannot be settled until their receipt and examination preparatory to delivery to the Comptroller for final audit and payment.

The cost of the mobilization camp and the State encampment for the 2d and 3d Infantries will aggregate the full amount (\$70,000) appropriated for annual encampments, but as the details vary so much from the itemized cost of a regular State encampment of all organizations of the National Guard, their publication here would be of no value for purposes of comparison for future State encampments.

QUARTERMASTER GENERAL'S REPORT.

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ABSTRACT OF PAY.

NATIONAL GUARD.

ORGANIZATIONS.	Officers.	Enlisted, Men.	Total.	U. S. Pay.	State Pay.	Total Pay.
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Camp of Instruction, Fort Myer, Virginia.

Officers and N. C. O., 1st Squad. Cav.,	7	31	38	\$498 29	\$199 90	\$698 19
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Mobilisation at Sea Girt, N. J.

Officers Q. M. Corps,	10	6	16	\$937 33		\$937 33
Officers Ord. Dept.,	1	1	1	83 33		83 33
Officers Adj. Genl. Dept., ..	5	5	5	180 55	\$305 56	486 11
Medical Dept.,	11	11	11	630 56		630 56
Recruit Detachment,	6	14	20	228 49		228 49
	33	20	53	\$2,060 26	\$305 56	\$2,365 82

Second Infantry Regular Encampment, Sea Girt.

Field Staff and Band,	15	47	62		\$1,471 31	\$1,471 31
Supply Co.,		33	33		307 50	307 50
Machine Gun Company,		38	38		370 50	370 50
Sanitary Troops,	4	16	20		308 16	308 16
Company A,	3	61	64		664 16	664 16
Company B,	3	56	59		616 16	616 16
Company C,	3	62	65		670 16	670 16
Company D,	3	61	64		665 66	665 66
Company E,	3	60	63		658 16	658 16
Company F,	2	61	63		635 83	635 83
Company G,	1	71	72		672 33	672 33
Company H,	2	57	59		596 33	596 33
Company I,	2	58	60		611 83	611 83
Company K,	2	58	61		635 66	635 66
Company L,	2	57	59		566 83	566 83
Company M,	3	54	57		599 66	599 66
	49	850	899		\$10,050 24	\$10,050 24

Third Infantry Regular Encampment, Sea Girt.

Field Staff and Band,	15	22	37		\$1,114 65	\$1,114 65
Headquarters Company,		25	25		241 50	241 50
Supply Co.,		21	21		196 50	196 50
Sanitary Troops,	4	10	14		251 16	251 16
Company A,	3	62	65		637 16	637 16
Company B,	2	65	67		635 83	635 83
Company C,	2	63	65		622 33	622 33
Company D,	3	59	62		644 66	644 66
Company E,	2	65	67		650 66	650 66
Company F,	2	62	64		639 83	639 83
Company G,	3	50	53		556 16	556 16
Company H,	3	61	64		658 16	658 16
Company I,	3	61	64		658 16	658 16
Company K,	2	65	67		673 33	673 33
Company L,	3	64	67		680 66	680 66
Company M,	2	65	67		671 83	671 83
Detachment 2d Infantry, ..	1	1	2		40 33	40 33
					\$9,572 91	\$9,572 91

Rifle Practice.

Range Officers,				\$1,396 45	\$1,396 45
Caretakers, scorers, pitmen, etc.,				\$3,103 67	3,103 67
					\$4,500 12

6 QUARTERMASTER GENERAL'S REPORT.

NAVAL RESERVE. CRUISES, RIFLE PRACTICE, ETC.

Cruises.

<i>Organisations.</i>	<i>Officers.</i>	<i>Seamen.</i>	<i>Total.</i>	<i>U. S. Pay.</i>	<i>State Pay.</i>	<i>Total.</i>	<i>Remarks.</i>
1st Battalion, ...	8	146	154	\$2,560 20	\$1,554 12	\$4,114 32	U. S. S. New Jersey, July 15-29, 1916.
2d Battalion,	9	136	145	2,834 23	1,357 60	4,191 83	U. S. S. Maine, July 15-29, 1916.
2d Battalion,	2	3	5	202 02	21 30	223 32	U. S. S. Chicago, July 15-29, 1916.
	19	285	304	\$5,596 45	\$2,933 02	\$8,529 47	

Rifle Practice.

1st Battalion, ...	9	75	84	\$276 10	.....	.....	Sea Girt, August 21-23, 1916.
2d Battalion,	10	44	54	283 90	.....	.....	Sea Girt, August 24-26, 1916.
	19	119	138	\$560 00	\$560 00	

Aviation Camp.

1st Battalion, ...	1	13	14	\$171 62	\$171 62	Keyport, August 9-23, 1916.
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NAVAL MILITIA.

Expenditures from Federal funds for cruises, rifle practice, aviation field, etc., by the Quartermaster General as U. S. Disbursing Officer.

1st Battalion—Rifle practice,	\$283 90
Mileage, officers,	74 88
Subsistence, men,	152 67
Pay for services in aviation field,	171 62
Subsistence, in do.,	41 55
Transportation, in do.,	15 75
2d Battalion—Subsistence, 1915,	318 00
Rifle practice, pay,	268 34
Mileage, officers,	119 20
Subsistence, men,	94 33

\$1,540 24

QUARTERMASTER GENERAL'S REPORT.

7

With the above expenditures all payments from Federal funds by the Quartermaster General as disbursing officer are terminated. Under the Naval Militia act approved Aug. 29, 1916, the disbursing officer for the Naval Militia must be an officer of the Pay Corps of that organization and all disbursements from Federal funds for the Naval Militia will be made by said officer.

Receipts and expenditures, United States funds in connection with mobilization of the New Jersey troops by the property and disbursing officer.

RECEIPTS.

Supplies, Services and Transportation, Q. M. C.	Pay of Army.	Horses, Cavalry, Artillery, Engrs., Etc.	Total.	Total.
\$67,721 00	\$7,000 00	\$94,917 00	.....	\$169,638 00

EXPENDITURES.

	\$58,029 10	\$307 83	\$94,917 00	\$153,253 93	.....
Funds Ret,...	9,691 90	6,692 17	.....	16,384 07	.....
	<u>\$67,721 00</u>	<u>\$7,000 00</u>	<u>\$94,917 00</u>	<u>\$169,638 00</u>	<u>\$169,638 00</u>

RECEIPTS FROM THE UNITED STATES.

SECTION 1661 R. S.

Nov. 1, 1915.	Balance,	\$14,596 27
	Recredits,	380 37

RECEIPTS.

Publications,	\$937 92	\$14,976 64
Ordinance and Q M. stores,	5,888 88	
Expenses on stores,	204 54	

Total,	\$7,031 34
Expended by Disbursing Officer in funds,	6,690 63

	\$13,721 97	
Oct. 31, 1916. Balance,	1,254 67	\$14,976 64

CASH RECEIPTS AND EXPENDITURES QUARTERMASTER GENERAL'S FUNDS.

Dr.

Nov. 1, 1915.	To Balance,	\$1,829 15
	" Int. to Oct. 31, 1916,	140 81
	" Receipts, settlement of officers' acc'ts, sales, etc.,	12,012 99
		<u>\$13,982 95</u>

8 QUARTERMASTER GENERAL'S REPORT.

Cr.

Oct. 31, 1916. By expenditures to date, \$6,127 86
 Balance, 7,855 09

\$13,982 95

EXPENSES OF THE NATIONAL GUARD.

<i>Object Symbol.</i>	<i>Amount of Appropriation.</i>	<i>Delivered to Comptroller for Settlement.</i>
Expenses division, brigades, regiments, troops, batteries, etc.,	\$50,600 00	\$50,600 00
For support and maintenance of Field Hospital and Medical Corps,	1,500 00	1,169 39
For allowance for uniforms and equipment for commissioned officers,	6,500 00	6,018 57
Horse allowance for officers required to be mounted,	2,500 00	939 00
For traveling expenses of U. S. Army officers detailed to State by War Department,	1,000 00	1,000 00
For horse allowance, mounted organizations, ...	4,900 00	4,900 00
For pay of clerk attached to Inspector-Instructor's office,	600 00	600 00
Maintaining, etc., Regimental Armories—		
Jersey City,	4,400 00	4,330 00
Camden,	4,400 00	4,400 00
Newark,	4,400 00	3,460 00
Paterson,	4,400 00	4,392 38
Trenton,	4,400 00	4,399 85
Maintaining, etc., Battery, Troop and Battalion Armories at Newark, E. Orange, Camden, Elizabeth, Red Bank and Orange,	22,000 00	21,518 42
Maintaining, etc., Company Armories—		
Somerville,	1,500 00	1,499 11
Hackensack,	1,500 00	1,119 76
Bridgeton,	1,500 00	1,500 00
Asbury Park,	1,500 00	1,491 81
New Brunswick,	1,500 00	1,486 31
For transportation for battalion drills, etc.,	4,500 00	4,499 19
For compensation officers and employees and expenses of rifle practice,	8,000 00	7,958 98
To pay of officers and enlisted men and expenses annual encampment,	70,000 00	67,608 60
For compensation of Superintendent and employees, forage, fuel, etc., State Camp Grounds,	9,000 00	8,985 91
For fuel, light and maintenance of State Arsenal,	1,500 00	1,496 51
For expenses of military boards and courts-martial,	1,000 00	998 96

QUARTERMASTER GENERAL'S REPORT.

9

<i>Object Symbol.</i>	<i>Amount of Appropriation.</i>	<i>Delivered to Comptroller for Settlement.</i>
For transportation of disabled soldiers,	\$30 00	\$14 63
For insuring Regimental Armories, buildings at State Camp Grounds, Sea Girt, State Arsenal and all public military stores,	4,880 00	4,016 88
For ordnance stores, uniforms, clothing, camp and garrison equipage, etc.,	10,000 00	9,364 46
For construction and extraordinary repairs to armories, .....	.....	.....
For constructing and equipping blacksmith shop, Battery "B" Armory, Camden,	850 00	800 00
For construction of armory, 1st Batt., 5th Inf., Orange,	20,000 00	19,835 48
For constructing armory, 2d Inf., at New Brun- swick,	5,742 88	5,377 64
For extraordinary repairs, etc., for armories at Newark, Trenton, Jersey City, Camden, Pat- erson, Red Bank, Somerville and New Brun- swick,	8,000 00	7,361 27
For construction of two jetties and repairing and replacing bulkheads on ocean front, State Camp Grounds, Sea Girt,	10,000 00	9,974 59
For salary of caretaker of military equipment of Signal Corps Co. claims,	900 00	900 00
For clothing reimbursement and extra compensa- tion Spanish-American War,	32 37	23 08
For settlement of claims of sundry enlisted men injured or killed while in State service,	685 85	534 85
To Bennett & Gifford, for claim for property damaged by troops at Manasquan,	180 00	180 00

NAVAL RESERVE.

1st Battalion—Maintenance,	6,500 00	6,484 77
Cruise,	4,800 00	1,830 93
2d Battalion—Maintenance,	6,500 00	6,470 96
Cruise,	4,800 00	3,783 62

\$297,001 10 \$283,325 91

Respectfully submitted,

C. EDW. MURRAY,
Quartermaster General.

Report of the Quartermaster General.

For the Year 1915.

To the Governor:

Pursuant to law I submit herewith my report for the fiscal year ended October 31, 1915.

MILITARY PROPERTY.

The equipment of the organizations of the National Guard is now prescribed in Unit Equipment Manuals issued periodically by the War Department, and this State is required to maintain on hand sufficient equipment for the peace strength of the organizations on the basis of the Unit Manuals. The sufficiency of equipment is determined annually by army inspectors at the inspection of all organizations of the State, and the last inspection developed the fact that the State was properly and suitably equipped to meet the requirements of the War Department for peace strength, with an excess of approximately five per cent. in store at the arsenal for the purpose of making replenishment in worn equipment.

EXPENDITURES.

The amounts expended from both State and Federal funds for the maintenance of the National Guard and Naval Reserve, including pay of officers and enlisted men at encampments, practice marches and cruise during the year, are shown in the following abstract of expenditures:

QUARTERMASTER GENERAL'S REPORT.

ABSTRACT OF PAY.

NATIONAL GUARD.

<i>Organisation.</i>	Officers.	Enlisted Men.	Total.	U. S. Pay.	State Pay.	Total Pay.
Commd. & N. C. Officers, Fld. Art. at Tobyhanna, ..	2	10	12	\$259 72	\$116 25	\$375 97
Commd. & N. C. Officers, Signal Corps at Fort Leavenworth,	3	3	6	349 87	16 80	366 67
Commd. & N. C. Officers, Cavalry at Fort Myer, Va.,	3	10	13	232 44	62 00	294 44
Officers' School of Instruction at Sea Girt,	194	19	213	.....	7,501 44	7,501 44
Battery "A," Field Artillery at Tobyhanna,	5	105	110	.....	1,813 23	1,813 23
Spl. Med. examination at E. Orange,	1	.....	1	.....	6 67	6 67
Sanitary troops with do., ..	1	3	4	.....	111 67	111 67
Battery "B," Field Artillery at Tobyhanna,	5	96	101	.....	1,743 73	1,743 73
Sanitary troops with do., ..	1	4	5	.....	131 67	131 67
Signal Corps, Practice March	5	60	65	.....	744 32	744 32
School of Musketry, Sea Girt,	58	265	323	.....	2,356 51	2,356 51
Command. & N. C. Officers, Med. Dept. at Tobyhanna,	23	27	50	1,217 66	122 08	1,339 74
Non-Commissioned Officers' Camp at Sea Girt,	20	615	635	.....	7,871 14	7,871 14
First Squadron Cavalry at Mt. Gretna,	16	195	211	1,591 31	1,395 14	2,986 45
Field Hospital at Tobyhanna,	5	33	38	.....	938 22	938 22
Ambulance Co., Tobyhanna,	4	33	37	.....	820 88	820 88
Totals,	346	1478	1824	\$3,651 00	\$25,751 75	\$29,402 75

RIFLE PRACTICE.

Range Officers, .....	.....	.....	.....	\$3,166 09	\$1,463 91	\$4,630 00
Scorers and Pitmen, .....	.....	.....	.....	5,068 83	.....	5,068 83
Totals, .....	.....	.....	.....	\$8,234 92	\$1,463 91	\$9,698 83

CRUISES, NAVAL RESERVE.

1st Battalion, U. S. S. Kentucky,	11	141	152	\$2,886 12	\$1,431 85	\$4,317 97
2d Battalion, U. S. S. Kentucky,	5	100	105	1,716 80	1,027 10	2,743 90
2d Battalion, U. S. S. Vixen,	8	66	74	1,749 00	731 00	2,480 00
Totals,	24	307	331	\$6,351 92	\$3,189 95	\$9,541 87

QUARTERMASTER GENERAL'S REPORT. 13

EXPENSES INCURRED DURING THE SEVERAL ENCAMPMENTS AND PRACTICE MARCHES AT SEA GIRT, NEW JERSEY, TOBYHANNA AND MT. GRETN, PENNSYLVANIA, ETC.

Labor and teams,	\$1,158 57
Forage and straw,	854 08
Freight, expressage, etc.,	317 67
Fuel,	207 50
Horse hire, including commissioned officers and mounted enlisted men,	7,344 00
Pay,	25,751 75
Subsistence,	2,172 42
Transportation,	11,608 89
Miscellaneous, clerical, medical supplies, stationery, electric lighting, etc.,	475 81
Total,	\$49,890 69

RECEIPTS FROM THE UNITED STATES.

The total amount of moneys and stores drawn and the available balances remaining under the several Federal Appropriations for Arming and Equipping were as follows:

ARMS, EQUIPMENT AND CAMP PURPOSES, SECTION 1661.

Balance November 1, 1914,	\$6,663 91
Allotment for fiscal year ending June 30, 1916,	37,683 86
	<u>\$44,347 77</u>
Expended as per requisitions of the Governor, for moneys and stores,	\$30,858 57
Less recredits,	1,107 07
	<u>29,751 50</u>
Balance October 31, 1915,	\$14,596 27

PROMOTION OF RIFLE PRACTICE, SECTION 1661.

Balance November 1, 1914,	\$4,997 00
Allotment for fiscal year ending June 30, 1916,	12,561 29
	<u>\$17,558 29</u>
Expended as per requisitions of the Governor for moneys and stores,	\$17,387 60
Less recredits,	1,215 00
	<u>16,172 60</u>
Balance October 31, 1915,	\$1,385 69

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ACT OF MAY 27, 1908.

FIELD ARTILLERY AMMUNITION.

Balance November 1, 1914,	\$84 76
Recredits,	1 19
Allotment O. M., 1916,	<u>3,234 42</u>
	\$3,320 37
Expenditures of F. A. ammunition,	<u>2,668 59</u>
Balance October 31, 1915,	\$651 78

SMALL ARMS AMMUNITION.

Balance November 1, 1914,	\$7,930 84
Allotment O. M., 1916,	<u>14,089 44</u>
	\$22,020 28
Requisitions of Governor,	<u>19,856 57</u>
Balance October 31, 1915,	\$2,163 71

SUPPLIES.

Balance November 1, 1914,	\$35,612 00
Allotment O. M., 1916,	<u>44,284 09</u>
	\$78,896 09
Requisitions of Governor,	<u>79,896 09</u>
Balance, .....	.....

NAVAL RESERVE.

As the Division of Naval Militia Affairs was not prepared at close of business Oct. 31, 1915, to furnish an accurate statement of charges during the year, the available balance cannot now be given.

CASH RECEIPTS.

Q. M. GENERAL'S FUND.

Balance November 1, 1914,	\$2,310 79
Receipts to October 31, 1915,	<u>7,176 68</u>
	\$9,487 47
Bills paid by Q. M. General,	\$7,658 32
Balance October 31, 1915,	<u>1,829 15</u>
	\$9,487 47

QUARTERMASTER GENERAL'S REPORT. 15

EXPENSES OF THE NATIONAL GUARD.

Allowances to Brigade and Regimental Headquarters, Companies of Infantry, Troops, Batteries, and Signal Corps Co.,	\$50,600 00
Allowance for uniforms for officers,	6,435 27
Allowance for horses for officers,	924 00
Allowance for horses provided for State service by mounted organizations,	3,900 00
Allowance for caretaker, Signal Corps Co.,	900 00
Allowance for Field Hospital and Medical Corps Co.,	1,313 08

ARMORIES.

Construction,	\$108,413 95
Furnishing and equipping,	13,328 67
Maintenance,	52,114 95
Repairs (extraordinary),	17,378 47
Paving assessment (Elizabeth Armory),	1,058 84
	<hr/> 192,294 88

CAMP GROUNDS.

Maintenance,	\$7,999 33
New boiler, water tank, etc.,	1,808 60
Governor's cottage,	463 02
	<hr/> 10,270 95
Encampments,	49,890 69
Expenses, Inspector Instructors, U. S. A.,	995 42
Insurance,	12,746 77
Military Boards and Courts-Martial,	997 19
Ordnance stores, clothing, etc.,	6,395 95

RIFLE RANGE AND PRACTICE.

Regular appropriation,	\$7,840 33
Special appropriation (10-year medals),	997 20
	<hr/> 8,837 53
State Arsenal,	1,499 69
Transportation, etc., battalion drills, etc.,	4,487 07
Transportation, disabled soldiers,	18 57
	<hr/> \$352,507 06
From Federal appropriations,	148,345 35
	<hr/> \$500,852 41

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NAVAL RESERVE.

First Battalion.

Pay of Shipkeeper, maintenance, etc.,	\$6,461 71	
Cruise,	\$1,602 50	
Federal funds,	2,886 12	
	<hr/>	4,488 62
		<hr/> \$10,950 33

Second Battalion.

Pay of Shipkeeper, maintenance, etc.,	\$6,435 27	
Cruise,	\$4,174 24	
Federal funds,	3,465 80	
	<hr/>	7,640 04
		<hr/> 14,075 31
		<hr/> \$25,025 64

RECAPITULATION.

National Guard,	\$500,852 41	
Naval Reserve,	25,025 64	
	<hr/>	\$525,878 05

C. EDW. MURRAY,
Quartermaster General.

Document No. 51

ANNUAL REPORT
OF THE
BOARD OF MANAGERS
OF THE
New Jersey State Hospital
AT
TRENTON, NEW JERSEY

For the Year ending October 31st, 1916

ANNUAL REPORT
OF THE
BOARD OF MANAGERS
OF THE
New Jersey State Hospital
AT
TRENTON, N. J.
FOR THE
Year Ending October 31
1916



RAHWAY, N. J.
NEW JERSEY REFORMATORY PRINT

—
1917

Board of Managers

LUTHER M. HALSEY, M. D., President.....Williamstown
ARTHUR D. FORST, Vice-President.....Trenton
STEWART PATON, M. D.....Princeton
JOSEPH RAYCROFT, M. D.....Princeton
ALFRED L. ELLIS, M. D.....Metuchen
GEORGE T. TRACEY, M. D.....Beverly
JOSEPH H. MOORE.....Hopewell
WILLIAM L. BLACK.....Hammonton

SCOTT SCAMMELL, Secretary.....Trenton
HARVEY H. JOHNSON, Treasurer.....Trenton

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JOSEPH RAYCROFT, M. D. GEORGE T. TRACEY, M. D.
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HOUSE AND GROUNDS COMMITTEE

ARTHUR D. FORST, Chairman
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AUDITING COMMITTEE

JOSEPH H. MOORE, Chairman
WILLIAM L. BLACK

SALARY COMMITTEE

ARTHUR D. FORST, Chairman
WILLIAM L. BLACK GEORGE T. TRACEY, M. D.

Resident Officers

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EDGAR B. FUNKHOUSER, M. D.....	First Assistant Physician
RALPH P. TRUITT, M. D.....	Second Assistant Physician
JOSEPH L. GARISS, M. D.....	Senior Assistant and Roentgenologist
PAUL B. MEANS, M. D.....	Senior Assistant Physician
LILLA RIDOUT, M. D.....	Woman Physician
W. W. STEVENSON, M. D.....	Clinical Pathologist
JAMES P. SANDS, M. D.....	Assistant Physician
R. GRANT BARRY, M. D.....	Assistant Physician
E. P. CORSON WHITE.....	Director of Clinical Research
JOHN A. FLOOD, D. D. S.....	Resident Dentist

BUSINESS DEPARTMENT

SAMUEL T. ATCHLEY.....	Warden
------------------------	--------

Consulting Staff

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M. D., FRANK G. SCAMMELL, M. D.

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ZIE, M. D., MARTIN W. REDDAN, M. D.

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GEORGE H. PARKER, M. D.

NEUROLOGISTS

PAUL L. CORT, M. D., STEWART PATON, M. D.

OPHTHALMOLOGISTS

CHARLES F. ADAMS, M. D., DR. IRVINE E. P. TURNER

DENTIST

DR. JAMES I. WOOLVERTON

Letter of Transmittal

Trenton, New Jersey, May 18, 1917.

To His Excellency, Governor Walter E. Edge, Trenton, N. J.

Dear Sir:—Enclosed herewith the annual report of the Board of Managers of the New Jersey State Hospital at Trenton, together with the report of the Medical Director and Warden of that institution.

Very truly,
SCOTT SCAMMELL,
Secretary.

Report of Board of Managers

To His Excellency, Governor Walter E. Edge:

Dear Sir:—The Board of Managers of the New Jersey State Hospital at Trenton respectfully submits the Sixty-ninth Annual Report which covers the period, November 1, 1915, to October 31, 1916.

Appended are the reports of the Medical Director and the Warden which give detailed statements and records of the medical and business conduct of the institution during the year.

We respectfully call your attention to one feature of the medical work, namely a systematic investigation as to the causes of many obscure mental conditions. In every case admitted a very complete physical examination is supplemented by thorough examinations of the blood, spinal fluid, urine, etc, by means of methods adopted in the clinical laboratory. It is often difficult to determine by the physical examination alone whether or not the patient is suffering from some chronic infection which is not evident except perhaps in the loss of weight and general run down condition of the patient. By the newer methods adopted in the laboratory it is possible to discover infections and toxic conditions which are important factors in the causation of the mental condition. From the fact that nearly 6,000 such examinations were made in the laboratory will give you some idea as to the amount of work necessary to determine these obscure factors. We feel that everything possible is being done to ascertain the cause of the patients' mental trouble and only through finding the cause are we able to do something towards a cure. It

must be remembered, however, that many of the mental conditions from which the patients suffer are very obscure and therefore the cause is very difficult to determine and only by systematic and routine work, as is described in the Medical Director's report, can we hope to get definite results.

We would also call your attention to the work done in the treatment of paresis which up to three years ago was considered a fatal disease, often causing the patient's death within a few years after its onset. The average length of time in the hospital of such cases was a year and a half. During the last year twenty cases of paresis have been discharged, many able to resume their work, and this represents 38% of the number of cases admitted. The treatment as developed in this hospital has proved very efficient and if we could prevail upon friends and relatives of patients as well as physicians to send such cases to the hospital while in the early stage of the disease our successful cases would be much larger than they are today.

During the epidemic of infantile paralysis, which occurred last summer, the Board of Managers realized that the facilities of this hospital should be made available for the diagnosis and treatment of such cases and offered the services of the staff and facilities of the hospital to the City Commissioners of Trenton who availed themselves of this offer. Practically all the cases occurring in the city were diagnosed by means of laboratory findings and treated by members of the Staff. A confirmed diagnosis in a large number of these cases and removal of the same to the Municipal Hospital had a very good effect on limiting the epidemic, otherwise it might have assumed larger proportions.

It is also gratifying to know that the number of voluntary admissions has increased by fifteen over the number received last year.

A routine use of the X-ray apparatus has been made possible by one of the members of the Staff taking up this work in addition to his regular duties.

PREVENTION OF INSANITY.

We feel that not only should the hospital be concerned with the causes of insanity and their cure when the patients reach the hospital, but there is a great field for the promotion of mental diseases of which the laity know very little about. If the scientific knowledge now available had been utilized to the best advantage probably one-half or at least one-third of the cases now under treatment in the State Hospitals could have been prevented. The public should recognize the full significance of this fact. The mental balance, or the capacity to adjust oneself to the higher levels, may be very easily disturbed by disease

affecting the internal organs. Alcohol taken in excess accounts for nearly one-third of the male patients admitted to the hospital. Syphilis, a venereal disease, accounts for about 10 per cent. of the admissions in the form of paresis. It is not sufficient to inveigh against these insidious causes, but care should be taken to discuss all causes and cultivate in all persons a rational attitude in discussing these important questions.

Public officials should be made to realize that education is a process of assisting an individual to live rationally and therefore happily. The present methods have very little in common with this idea. The value of the formation of habits, facing all critical situations in life squarely and cultivating good mental habits, is an effective means of preventing nervous and mental breakdowns. There should be frequent conferences between parents, teachers, social workers, physicians and medical officers of our State Hospitals, while intelligent and persistent effort should be made to afford greater facilities for the scientific study of mental disease and investigations of its causes and the determination of the best methods to prevent its incidence. Many cases of mental disease appear to be a disordered behavior due to a person's inability to adjust life successfully and happily at a level at which he or she has attempted to live. Successful living requires a rational expenditure of energy in both work and play. Any effort made to adjust life at a level above our actual capacity does not satisfy these conditions. The experience of having made good at our work is necessary in order to maintain our mental adjustments. Egotism, failure of intelligent sympathy, envy, hatred, are signs of imperfect adjustment and should be recognized as such.

At the present rate of increase of nervous and mental diseases, the burden of caring for the patients afflicted with these disorders will soon become too great for our civilization to carry unless we quickly adopt more rational and effective methods in preventing the spread of this disease.

We respectfully call your attention to the efficient methods in the Warden's department. With the increasing cost of supplies it is becoming more and more a problem of keeping the expenditures more within our income. Only with the most careful and conscientious management are we able to administer the affairs of the hospital in a manner satisfactory to the patients and the public at large. It is necessary to utilize the patients' labor as far as possible in supplying sustenance to the institution. We call attention to the profit of maintaining the farm last year, \$15,625, and also the profit from maintaining the garden which is \$4,450. The profit from the dairy is also an important item, total \$12,562. Not only do we supply most of the milk used at the institution, but it is much better quality than any we could

buy. The net profit from the piggery amounts to \$994.00 a year.

We would recommend to you the faithful service of the Warden during the past year in meeting many of the difficult problems imposed upon him by the high cost of provisions. That he has been successful in maintaining the hospital in the proper manner is due largely to his conscientious and persevering work. We would also commend the work of the Medical Director and members of the Medical Staff who by their co-operation and faithful work have done much for the successful treatment of patients under their care.

Respectfully submitted,

LUTHER M. HALSEY, M.D., *President.*

ARTHUR D. FORST, *Vice-President.*

STEWART PATON, M.D.

JOSEPH RAYCROFT, M.D.

ALFRED L. ELLIS, M.D.

GEORGE T. TRACEY, M.D.

JOSEPH H. MOORE.

WILLIAM L. BLACK.

Medical Director's Report

To the Board of Managers of the New Jersey State Hospital at Trenton:

Gentlemen:—I have the honor to submit the sixty-ninth annual report of the operations of the Medical Department of the New Jersey State Hospital at Trenton for the year ending October 31, 1916.

At the beginning of the fiscal year there were present in the hospital 1,605 patients, 834 men and 771 women. During the year 661 patients were admitted, 385 men and 276 women; 3 patients were admitted from escape and 27 patients nominally admitted for discharge at the end of their four months' visit, making the total number under care 2,266. Of this number we have dismissed during the year 578, 323 men and 255 women, leaving the total number of patients under care November 1, 1916, 1,688, 896 men and 792 women, which is an increase of 56 in the daily average number of patients over the previous year. Of the total number of dismissals during the year, 323 men and 255 women, 195 total were discharged as recovered at the time of leaving the hospital. The recovery rate calculated upon the number of admissions is 30%. The recovery rate based upon the number of discharges is 61%. Counting the number of cases that were classified as recovered and those classified as capable of self-support, gives us 34% of the number of admissions, which means that these patients left the hospital in very good condition. We have discharged 20 cases of Paresis as capable of self-support, which is 38% of the number of cases of Paresis admitted.

The number of deaths during the year were 204, 100 men and 104 women, which is 57 more than last year. The death rate computed upon the number of patients under treatment during the year is 9%.

Of the number of patients on visit at the end of our fiscal year, 15 men and 12 women, total 27, were nominally admitted for discharge during the year. We have on visit at the end of this year 27 men and 28 women, total 55.

Three suicides occurred during the year. Two women in a chronic depressed condition wandered away from the hospital and later were found in the canal. One man, a morphine habitue who tried for years to overcome his habit, finally came to the hospital, and in a few weeks seemed to be improving. Suddenly one morning he went to his room, tied his bathrobe sleeve around his neck and was later found dead.

We were fortunate enough during the past year to escape any epidemic such as the typhoid epidemic of the year before. The fact that all patients have been immunized against typhoid fever, we feel, will eliminate such epidemics in the future.

INFANTILE PARALYSIS.

Upon the outbreak of the infantile paralysis in Brooklyn, New York, the Board of Managers passed a resolution offering the services of the institution and laboratory to the authorities of the city of Trenton in case the epidemic should visit Trenton. The city authorities accepted the offer of the Board, and soon afterwards cases began to be reported. In all there were examined over 190 cases in the city. This work was done by Dr. Stevenson, Clinical Pathologist, under the direction of the Medical Director. About 71 cases were treated at the Municipal Hospital. All reported cases and those admitted to the Municipal Hospital were treated by means of lumbar puncture and diagnosis made on the examination of spinal fluid in the laboratory. This caused considerable extra work, which was willingly performed and much appreciated by the city authorities.

Total cases punctured for the City Board of Health	190
Total cases positive	134
Total cases negative	56
Total cases of poliomyelitis at the City Hospital	65 or 38%
Total cases of poliomyelitis dying at City Hospital	15 or 23% of admissions
Recoveries at City Hospital.....	50 or 77% of admissions
Total cases of recovery in the City.....	118 or 70%
Total deaths in the City	51 or 30%

VOLUNTARY COMMITMENTS.

During the year 23 men and 24 women, total of 47, were received as voluntary patients, an increase of 15 over last year. We are much gratified in the steady increase year by year in the number of voluntary patients, and now that the Legislature has authorized the admission of indigent patients by this method, we think will cause a large proportion of such admissions. We have urged the physicians in the community to utilize the voluntary blanks as far as possible. The co-operation of the committing physicians and a better understanding by the public at large of the advantage of such admissions will assist us materially in obtaining patients in the early stages of their psychoses. A better knowledge of the etiology of the psychoses shows that it is imperative that all cases must be treated early if results are to be obtained. Some hospitals have voiced criticisms of the voluntary commitment, claiming they cause a lot of trouble and that patients so admitted have to be regularly committed later on. We are glad to state that such has not been our experience, and we have not had to commit any of the voluntary patients in the regular way.

NEW JERSEY STATE HOSPITAL

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MEDICAL STAFF.

There have been several important changes on the Medical Staff. Dr. Clarence B. Farrar, second assistant physician, who had been with us two years, resigned to take up work elsewhere. Dr. Ralph P. Truitt was appointed in his place. Dr. Truitt was formerly an interne at this hospital, following which service he was chief resident physician at Bay View Hospital, Baltimore, Md. Later he was assistant physician at Phipps Psychiatric Clinic, Johns Hopkins Hospital, Baltimore, Md., and afterwards accepted a position as clinical director in the State Hospital at Jackson, La. He resigned his position because of his inability to inaugurate any improvement in the conditions existing at that hospital. We feel that we are fortunate in obtaining his services again. Dr. Jos. L. Gariss, assistant physician, during the summer took a special course in Philadelphia, under Dr. Phaler, in roentgenology, and has been appointed roentgenologist in charge of the X-ray department. Dr. R. Grant Barry, formerly of the Worcester State Hospital, has been appointed as junior assistant physician. Dr. F. S. Hammond, formerly physician at this hospital, on leave of absence because of sickness, unfortunately has not recovered to the point where his services could be utilized by this hospital, and we much regret that we feel that it is necessary to accept his resignation because of ill health. Dr. Howard I. Gosline, graduate of Harvard Medical School, 1914, who had served in the psychopathic hospital in Boston, and as assistant physician at Danvers, and later pathologist at Worcester State Hospital, was appointed pathologist, and will enter on his duties the first of January, 1917. Dr. E. P. Corson White continues in charge of the serological work and clinical laboratory. She has stimulated the research work and assisted materially in our efforts to solve some of the fundamental problems concerning the etiology of the psychoses.

CONSULTING STAFF.

The death of Dr. H. G. Norton during the year has deprived us of a valuable member of the consulting staff. His place has been filled by Dr. George B. Moore. We again take this opportunity of extending our thanks to these men who have responded willingly to all our calls in time of emergency and rendered valuable assistance in the treatment of patients.

NURSING STAFF.

The continued improvement of the work of both male and female nurses is a subject for commendation. The fact that no cases of abuse have arisen during the year is a source of congratulation. The interest manifested by the nurses and attendants and hearty co-operation in all matters pertaining to the care of the patients is largely responsible for the attitude of the patients toward the hos-

pital on their discharge. Practically all the patients who have recovered are well satisfied with their treatment, and most of them return voluntarily if necessity requires. Since we have established relations with Mercer Hospital, where our nurses receive six months' training in general hospital work, we have noticed a considerable improvement in the work of the nurses. We have also been able to retain the services of our graduate nurses, and we hope soon that all our charge nurses will be graduates. The Legislature passed a law last year admitting the graduates of the State hospitals who have had six months in a training school of a general hospital to registration, and we feel that was a wise provision, as it gives the nurses of the State hospitals a standing they are entitled to for their three years' work. This provision will also attract a better class of nurses than we have been able to obtain in years past.

OCCUPATIONS AND AMUSEMENTS.

We have continued our encouragement of diversional occupation as in previous years, and we feel that results obtained are well worth the energy expended. When the new psychopathic building is open we will have ample provision for this work, and feel that its usefulness can be very much extended.

MEDICAL WORK.

During the last year we have extended the examinations of admitted patients to include complete clinical laboratory studies. All new patients have a routine Wasserman examination of the blood and a lumbar puncture to obtain spinal fluid for the cell count, globulin content, Wasserman test, and gold sol test. Both numerical and differential blood counts are also made in connection with the Abderhalden reaction. Routine bacteriological examinations are also made, and have added much to our knowledge of focal infections. While emphasizing the clinical laboratory side of the examinations we do not ignore the psychogenic factors, which may be of etiological importance, but we still feel that the study of etiology involves a full investigation of both pathologic and psychogenic factors. Many of our patients present serious physical disturbances, and it has been our object to ascertain if possible the relation between these physical disturbances due to focal infections and the psychosis. It is gratifying to know that members of the staff have also accepted this view in regard to etiology and are rendering valuable assistance in the study of these problems.

After considerable preparation our research work is now concerned largely with the etiology of the various psychoses. We are of the opinion that this field has been considerably neglected in the past, and largely accounts for our inability to cure many of our cases who become chronic, and our lack of this knowledge is largely responsible for this failure. In the case of General Paralysis where the

etiology is well established we have made considerable progress in the successful treatment of this disease. The main difficulty at present in the treatment of paresis is to be found in the fact that many of our cases when admitted are too far advanced for treatment to be of any benefit, whereas if these patients were sent in at the onset of their mental symptoms, especially when the physical signs were prominent, we feel that our results would be far greater. We cannot urge too emphatically upon the family physicians of patients the importance of recognizing paresis in the early stages and advising such patients to take immediate treatment. We are glad to say that quite a few physicians are able to recognize paresis and have referred these patients to us, and we have treated them with the result that it has not been necessary to commit them to a hospital for the insane. Many such patients have been treated in the Mercer General Hospital in the city of Trenton. The fact that we do get such results in the early cases substantiates our opinion that early cases of paresis can be successfully treated and cured.

In the case of many other psychoses, especially *Dementia Praecox*, Manic Depressive Insanity and various deliria, the etiology has not been so clear, consequently little has been attempted in the way of rational therapeutics. Through the work done in our laboratory in the last two years we feel that we have a better knowledge of the Manic Depressive group and the deliria than we have had previously. The results of this work will be the basis of papers to be given at the various medical societies this coming spring and summer. We have endeavored to utilize all of the recent clinical and pathological methods to determine the physical condition of our patients. The fact that we have found that focal infections and the absorption of toxins may appear in the etiology of certain groups primarily held to be purely psychogenic in origin may be received with skepticism by some, but at the same time we feel that we have demonstrated, especially from the therapeutic standpoint, the significance of our position.

The treatment of paresis has occupied a large part of our time, as in the last three years. We are now fortunate enough to obtain salvarsan, but while this drug could not be obtained we had to substitute diarsenol. At first we were of the opinion that the substitute was as good as salvarsan, but later experience led us to change that view. It is true that some cases have done remarkably well with diarsenol, but, on the other hand, many patients, in whom the prognosis seemed to be good, did not respond to diarsenol treatment. We have also adopted exclusively the intracranial methods for the administration of salvarsanized serum. We find that either the subdural or intraventricular methods, or both, are far more efficient than the intraspinal method. The results of Hammond and Sharpe, who have adopted the intraventricular method, have convinced us that their method should be employed wherever possible. We are able to accomplish more with three or four treatments of the intracranial

method than with twelve or fifteen intraspinal injections. In our first series of 11 cases treated three years ago only two have died. Some of them have shown relapses, but all had remissions of one to two years. In the last year patients treated by the intracranial method have shown a larger proportion of remissions, and the results seem to be very much superior to the intraspinal method. During the year 20 patients have been able to leave the hospital as arrested, and only two cases have returned for further treatment. The number of cases of paresis admitted was 52, and the percentage of arrested cases is 38. The results of our work with paresis are embodied in a paper given before the New York Psychiatric Society in November, 1916.

We have also published a preliminary report of the results of the Abderhalden examinations, with special reference to Dementia Praecox and Epilepsy. We were somewhat surprised to find that other groups of psychoses showed negative results with the Abderhalden test. Dementia Praecox cases have shown uniformly a strong reaction to the adrenal gland. We are now concerned with the significance of these reactions in these two groups.

DENTAL WORK.

The resident dentist has been kept busy during the year, not only with the routine examination of the patients' teeth, but he has also been examining all new patients in order to discover alveolar abscesses. In this work he has been assisted by X-ray plates of suspicious cases. He takes routine cultures from extracted teeth and ascertains the organism responsible for the abscess. He has also had supervision of the proper cleaning of the patients' teeth in the ward. Sufficient tooth brushes have been issued, and attempt has been made to have all patients take proper care of their teeth. In cases where patients are unable to use the tooth brush attempts have been made to have attendants pay more attention to this matter. The result of the dental examinations and the presence of alveolar abscess will be published this spring in a series of papers dealing with focal infections and mental disorders.

DENTAL REPORT.

Extractions	810
Gold fillings	3
Porcelain fillings	22
Amalgam fillings	82
Cement fillings	91
Upper plates	8
Lower plates	7
Repaired plates	9
Cleaned and polished	91
Repaired bridge	4
Porcelain crown	1

X-RAY WORK.

The appointment of Dr. Gariss, a member of the staff, to take charge of the X-ray work has resulted in an increased use of the apparatus as a means of diagnosis. X-ray films of the teeth are made in all cases where alveolar abscess is suspected. In some cases where the trouble is easily diagnosed by the dentist films are not made. The apparatus is also used in determining abnormal intestinal conditions which we believe play some part in the etiology of certain mental conditions. In our work of the past year we have sufficiently demonstrated the necessity for the use of an X-ray apparatus in assisting in determining some of the factors in the etiology of the psychoses.

LABORATORY REPORT.

The work of the laboratory continues to increase year by year, especially as we continue to add to the clinical methods. During the year the various examinations of diagnostic character were 5,772, compared with 3,222 last year. The number of autopsies performed was 83, which was 40% of the total number of deaths (204). The decrease in the mortality of paresis noted in our last report has not appeared in this year's statistics, and this is accounted for by the fact that in many of the cases length of life was considerably prolonged by treatment. This year there were 30 deaths from paresis, against 20 deaths the year before. The cases of General Paralysis who died after receiving treatment were 9, and the other cases who died had received no treatment. The following is a record of the psychoses in cases autopsied:

Alcoholism	3 or 3.6%
Arteriosclerotic Brain Disease	7 or 8.4%
Delirium, undifferentiated	6 or 7.2%
Dementia Praecox	13 or 15.6%
Epilepsy	4 or 4.8%
General Paralysis	16 or 19.2%
Huntington's Chorea	1 or 1.2%
Involutional Depression	2 or 2.4%
Imbecility or Idiocy	2 or 2.4%
Manic Depressive Insanity	4 or 4.8%
Organic Brain Disease	2 or 2.4%
Paranoid Condition	2 or 2.4%
Senile Dementia	8 or 9.6%
Unclassified	13 or 15.6%
The principal causes of death in these cases were:	
Apoplexy	1 or 1.2%
Cardio-vascular Renal Disease	24 or 28.9%

General Paralysis	15 or 18.0%
Pneumonia { Broncho, 9 }	19 or 22.8%
{ Lobar, 10 }	
Pulmonary Tuberculosis	10 or 12.0%
Miscellaneous	14 or 16.8%

Deaths that came to autopsies from cardio-vascular renal diseases were:

Male	11
Female	13

Deaths with no autopsy, diagnosed as cardio-vascular renal disease, were:

Male	20
Female	19

Total number of deaths from cardio-vascular disease 63 or 30.8%

Deaths that came to autopsy from general paralysis were:

Male	12
Female	3

Deaths with no autopsy, diagnosed as general paralysis, were:

Male	12
Female	3

Total deaths from general paralysis..... 30 or 14.7%

Deaths that came to autopsy from pneumonia were:

Male	10
Female	9

Deaths with no autopsy, diagnosed as pneumonia, were:

Male	9
Female	23

Total deaths from pneumonia..... 51 or 25.0%

Deaths that came to autopsy from tuberculosis were:

Male	3
Female	7

Deaths with no autopsy, diagnosed as tuberculosis, were:

Male	2
Female	7

Total deaths from tuberculosis..... 19 or 9.3%

The deaths from tuberculosis occurring in the hospital were 9.3%, which was about the same as in previous years. Twelve out of thirteen cases of dementia praecox died of tuberculosis. We have called attention before to the large proportion of dementia praecox patients who die of tuberculosis, and feel that it is of some significance.

Detailed account of the clinical work is as follows:

Abderhalden reactions	335
Complement fixation test	287
Wasserman, blood and cerebrospinal fluid.....	1,080
Cerebrospinal fluid counts (Hospital)	1,375
Cerebrospinal fluid counts of Inf. Paralysis cases.....	243
Surgical and clinical specimens from outside sources....	449
Urine	620
Throat cultures	106
Teeth cultures	200
Tonsil cultures	107
Urine cultures	139
Feces	230
Sputum	39
Blood counts	487
Miscellaneous bacteriological examinations, including milk and water	84
Total.....	5,772

FIELDWORK.

During the last year we were without the services of a field-worker for a few months until the appointment of Mrs. Florence VanDyck. At the present time the fieldwork is limited to after-care work of discharged patients, as we are unable to employ enough field-workers to continue the study of heredity as begun some years ago. We have now a large amount of material collected by the field-workers which we feel should be analyzed before expending any more time or money on the subject.

NEW BUILDINGS, IMPROVEMENTS, ETC.

The psychopathic wards for the female department, for which \$60,000 was appropriated in 1914, are about completed and will be occupied in the spring. We feel that such a department is very necessary for the proper treatment of patients. It also gives the public a different impression of the hospital, and we feel that we should have a large increase in the voluntary patients when they realize they will be treated in a psychopathic department and not in an "insane asylum." In spite of the improvements we have made in the hospital, to the public at large it still remains the "asylum," and if they can be told they are going to the psychopathic department I think a different impression will be the result. The center and one wing of the criminal insane building, for which \$150,000 has been appropriated, has been completed and is now ready for occupancy. However, it is necessary that an addition to the power plant should

be completed before this building can be occupied. The other wing of the building, for which \$110,000 was appropriated by the State Legislature, will be started as soon as the weather permits.

We respectfully request the Legislature the coming year to provide a psychopathic building for the male department, and have asked \$70,000 for this purpose.

The problem of housing our attendants and the increasing number of attendants made necessary by the opening of the criminal insane building has become more and more difficult. We have decided to construct a building in connection with the annex which will serve as congregate dining room for the annex patients, and which will also contain quarters for the male attendants. We request \$90,000 for this additional building. This will release at least one hundred rooms for patients in the main building which are now occupied by the attendants. It will make accommodations for one hundred patients in the annex building, which rooms have been occupied by attendants, and will result in a more economical management in the feeding of the patients in this building. We again ask for \$1,500 for laboratory supplies, and \$2,500 for research work.

CONCLUSION.

I again wish to express my thanks and appreciation for the valuable assistance and support of the Board of Managers during the past year. The active interest taken by the various committees in the work of the hospital is a source of gratification and encouragement to the Medical Director and Medical Staff. I also desire to express my appreciation of the work of the Medical Staff, who, by their loyalty, co-operation and efficiency, have aided us materially in maintaining the high standard set by your Board. The Warden and members of his department have, as in the past, rendered at all times valuable assistance to the medical department. To the supervisors, nurses and attendants I also wish to express my thanks for their loyalty and co-operation in the very important work in looking after the interests of the patients.

Respectfully submitted,

HENRY A. COTTON,

Medical Director.

Warden's Report

October 31st, 1916.

To the Board of Managers of the New Jersey State Hospital at Trenton:

Gentlemen:—In accordance with the laws of the State of New Jersey, I herewith respectfully submit the annual report of the business department covering a period from November 1st, 1915, to October 31st, 1916, the end of the fiscal year. This report shows amount of cash receipts and expenditures, appraisement of personal property, also tabulated statements appended showing in detail the products of the farm, garden and dairy, the value of the different products and cost of producing same, also an analysis expense report.

The cash receipts and payments have been as follows:

Balance in hands of Treasurer, November 1st, 1915.....	\$ 26,529.73
Cash receipts from all sources	409,852.33
Cash payments for the year	364,857.59
Cash balance October 31st, 1916	71,524.47

The average number of patients for the year was 1,644, making the average cost of maintenance per patient per annum \$240.95, or \$4.63 per week.

INVENTORY.

The annual appraisement of the personal property of the institution was made during the month of October. The personal property amounts to \$262,731.92. Messrs. John W. Hendrickson and Lloyd H. Rockhill, who were appointed by the Board of Managers, assisted in making the appraisement, and their services were highly satisfactory.

APPRAISEMENT.

Buildings, grounds, etc., valued at.....	\$1,749,306.76
Personal property appraised as above.....	262,731.92

FARM REPORT FOR YEAR ENDING OCTOBER 31st, 1916.

5,440 bushels potatoes @ \$1.50.....	\$ 8,160.00
600 tons ensilage @ \$5.00.....	3,000.00
73 tons alfalfa hay @ \$24.00.....	1,752.00
39 tons mixed hay @ \$18.00.....	702.00
45 tons straw @ \$12.00.....	540.00
1,000 bushels wheat @ \$1.25.....	1,250.00
54 calves sold	437.00
6,921 pounds tankage and bones sold.....	47.50
1,181 pounds beef hides sold @ 12c.....	141.72
5,172 pounds beef slaughtered.....	646.50
712 dozen eggs @ 33c.....	234.96
10 bushels apples @ \$1.00.....	10.00
Money received for board.....	260.00
28,350 pounds pork raised, killed and used for the Hospital.....	3,967.48
1,225 bushels shelled corn @ \$1.00.....	1,225.00
4,200 bundles corn stalks @ 3½c.....	147.00
1 load pumpkins	5.00
331,288 quarts milk @ 7½c.....	24,846.60
266 pounds chickens @ 25c.....	66.50
85 bushels tomatoes @ 70c.....	59.50
43 bushels string beans @ \$1.50.....	64.50
23 bushels lima beans @ \$1.50.....	34.50
2,000 ears corn, \$1.50 per 100.....	30.00
10 bushels beets @ 75c.....	7.50
10 bushels onions @ \$1.74.....	17.40
11 baskets cherries @ \$1.00.....	11.00
29 baskets pears @ 60c.....	17.40
25 bunches green onions @ 4c.....	1.00
100 quarts strawberries @ 10c.....	10.00
200 heads lettuce @ 5c.....	10.00
10 bushels peas @ \$1.50.....	15.00
750 bunches celery @ 6c.....	45.00
100 bunches radishes @ 4c.....	4.00
125 quarts blackberries @ 10c.....	12.50
60 bunches rhubarb @ 7c.....	4.20
2 bushels grapes @ \$2.00.....	4.00
3 bushels egg plants @ \$1.50.....	4.50
100 heads cabbage @ 9½c.....	9.50
2 bushels carrots @ \$1.00.....	2.00
2 bushels peppers @ 75c.....	1.50
2½ bushels cucumbers @ \$1.50.....	3.75

\$47,808.01

EXPENSES.

Purchasing and keeping hogs in feed, wear, tear on wagon, keeping horse, etc.....	\$ 750.00
Expense making sausage and scrapple.....	138.47
Fertilizers, manure, seeds, etc.....	1,683.12
26 tons burnt lime	172.00
20 tons hydrated lime @ \$7.00.....	140.00
Wages	6,467.67
Feeding cows and horses.....	12,675.11
Insurance on live stock and equipment.....	\$26,871.75
Farm buildings	20,950.00

Farm product and equipment.....	7,702.25	
Total at \$0.38 $\frac{3}{4}$ %	\$55,524.00	214.69
Total at \$0.38 $\frac{3}{4}$ %	\$55,524.00	214.69
Interest on investment \$88,000.00 @ 5%		4,440.00
Horseshoeing, wear, tear, etc.		1,000.00
Sundries		275.00
Board of men		3,528.00
Extra labor plowing, filling silo, etc.		325.00
65 tons coal @ \$5.75 ton		373.75
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Profit maintaining the farm one year.....	\$32,182.81	\$15,625.20

GARDEN REPORT FOR YEAR ENDING OCTOBER 31, 1916.

Valuation of machinery, stock and greenhouse equipment, October 31st, 1916	\$ 8,888.70
1,006 bunches asparagus @ 20c.....	201.20
7,555 bunches rhubarb @ 7c.....	528.85
7,589 bunches radishes @ 4c.....	303.56
10,406 bunches onions (green) @ 4c.....	416.24
1,296 bunches parsley @ 4c.....	51.84
288 bunches kohlrabi @ 5c.....	14.40
4,340 heads lettuce @ 5c.....	217.00
385 heads cauliflower @ 20c.....	77.00
19,765 heads cabbage @ 9 $\frac{1}{2}$ c.....	1,877.68
490 bushels spinach @ 60c.....	294.00
126 bushels peas @ \$1.50.....	189.00
155 bushels onions @ \$1.74.....	269.70
580 bushels beets @ 75c.....	435.00
355 bushels string beans @ \$1.50.....	532.50
300 bushels carrots @ \$1.00.....	300.00
25 bushels cucumbers @ \$1.50.....	37.50
230 bushels lima beans @ \$1.50.....	345.00
19 bushels peppers @ 75c.....	14.25
62 bushels squash @ 60c.....	37.20
4 bushels okra @ \$1.50.....	6.00
1,103 bushels tomatoes @ 70c.....	772.10
101 bushels tomatoes (yellow egg) @ 80c.....	80.80
40 bushels tomatoes (green) @ 75c.....	30.00
24 bushels grapes @ \$2.00.....	48.00
125 bushels egg plants @ \$1.50.....	187.50
57,855 ears corn @ \$1.50 per 100.....	867.83
5,120 quarts strawberries @ 10c.....	512.00
1 bushel lima beans (seed).....	5.00
250 heads endive @ 6c.....	15.00
18,000 heads celery @ 6c.....	1,080.00
1,500 bundles leek @ 5c.....	75.00
350 pounds horseradish @ 10c.....	35.00
300 bushels parsnips @ 60c.....	180.00
1,200 heads celeriac @ 4c.....	48.00
3 loads pumpkins @ \$5.00.....	15.00
5 bushels onion sets @ \$3.00.....	15.00
5 bushels brussels sprouts @ \$2.50.....	12.50
75 bushels kale @ 60c.....	45.00
250 bunches herbs @ 10c.....	25.00
1,000 bundles corn stalks @ 2 $\frac{1}{2}$ c.....	25.00

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4,200 bedding plants @ 5c.....	210.00
2,500 bunches cut flowers @ 20c.....	500.00
2,500 roses @ \$2.00 per 100.....	50.00
15,000 carnations @ \$3.00 per 100.....	450.00
2,000 pansy plants @ \$4.00 per 100.....	80.00
3,000 chrysanthemums @ 10c each.....	300.00
400 calla lilies @ \$15.00 per 100.....	60.00
Credit of hauling	175.00
Keeping of lawns	400.00
Manure	150.00
Credit of hauling ice for hospital.....	240.00
	<hr/>
	\$21,725.35

EXPENSE.

Fertilizers and manure	\$ 225.30
Seeds, sets, bulbs, etc.	182.45
Pots for plants	24.75
Keeping of horses	584.00
Wages	3,163.29
Horseshoeing, wear, tear, etc.	150.00
Hose, tools, etc.	200.00
Fuel for heating	150.00
Board of men	1,491.40
Interest on investment of \$45,000.00 @ 5%	2,250.00
Insurance on \$2,000.00, value of equipment, 39½ per \$100.00.	6.73
Value of machinery, stock and greenhouse equipment, Oct. 31, 1915	8,838.70
	<hr/>
	\$17,266.62
Profit maintaining garden one year	\$4,458.73

DAIRY REPORT FOR YEAR ENDING OCTOBER 31st, 1916.

Valuation of herd of cattle and equipment Oct. 31, 1916....	\$24,721.75
331,288 quarts milk produced @ 7½c.....	24,846.60
54 calves sold	437.00
6,921 pounds tankage and bones	47.50
1,181 pounds beef hides @ 12c.....	141.72
5,172 pounds beef slaughtered @ 12½c.....	646.50
45 bunches rhubarb @ 7c.....	3.15
75 quarts strawberries @ 10c.....	7.50
125 quarts blackberries @ 9c.....	11.25
4 baskets grapes @ \$1.00.....	4.00
19 baskets pears @ 50c.....	9.50
10 baskets apples @ 50c.....	5.00
6 baskets cherries @ \$1.00.....	6.00
750 stalks celery @ 6c.....	45.00
3 bushels egg plants @ \$1.50.....	4.50
100 heads cabbage @ 9½c.....	9.50
135 baskets tomatoes @ 35c.....	47.25
36 baskets lima beans @ 75c.....	27.00
75 baskets string beans @ 75c.....	41.25
6 bushels beets @ 75c.....	4.50
2 bushels carrots @ \$1.00.....	2.00
6 bushels onions @ \$1.74.....	10.44
100 heads lettuce @ 5c.....	5.00
25 bunches green onions @ 4c.....	1.00
2 bushels peppers @ 75c.....	1.50

500 ears corn @ \$1.50.....	7.50
7½ bushels peas @ \$1.50.....	11.25

\$51,105.16
EXPENSES.

93,810 pounds cornmeal	\$1,468.76
67,051 pounds brewers' grains	970.25
39,555 pounds bran	497.70
15,755 pounds oil meal	352.43
3,920 pounds calf meal	109.76
51,459 pounds beet pulp	706.08
395,250 pounds hay	4,347.73
970,000 pounds ensilage	2,425.00
20,785 pounds oats	347.33
15,625 pounds cottonseed meal	328.51
67,109 pounds unicorn	1,110.65
3,584 pounds salt	20.00
Wages	2,891.48
Patients' board and clothing	550.00
Dairy helpers' board	624.00
24 tons coal	138.00
Insurance on cattle and dairy equipment (\$24,721.75).....	95.59
12 milk cans	36.00
Tin pails, brushes, towels, forks, etc.	200.00
Keep of horses, repairs of wagon, etc.	400.00
Value of herd of cattle and equipment Nov. 1st, 1915.....	20,922.36

\$38,541.63

 Profit of maintaining dairy one year..... **\$12,563.53**

Report of hogs killed from November 30th, 1915, to March 28th, 1916, showing valuation of each item, also showing profit of \$994.01 by utilizing the product of our hogs for subsistence instead of selling them, as was the previous custom.

3,607 pounds pork loins valued at 16c.....	\$ 577.12
1,457 pounds spareribs valued at 13c.....	189.41
4,438 pounds lard valued at .1061c.....	470.87
800 pounds pigs' feet valued at 8c.....	64.00
4,510 pounds hams valued at 16c.....	721.60
947 pounds bacon valued at 18c.....	170.46
3,081 pounds salt pork valued at 11½c.....	354.20
5,328 pounds scrapple made @ 7c.....	372.96
185 pounds buckwheat @ 3¾c.....	\$ 6.94
590 pounds cornmeal @ 2¼c.....	13.28
23 pounds salt @ .005c.....	.12
10 pounds pepper @ .1475c.....	1.48
9 pounds sage @ 12c.....	1.08

Cost of material for scrapple.....	\$ 22.90	
6,158 pounds sausage @ 17c.....		1,046.86
33 pounds pepper @ .1475c.....	\$ 4.87	
99 pounds salt @ .005c.....	.50	
907 pounds beef @ .1215c.....	110.20	

 Cost of material for sausage..... **\$115.57**

 Cost of ingredients for scrapple and sausage **\$138.47**

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By slaughtering our hogs and making use of the product for subsistence we realized the value of.....	3,967.48
Would have realized on the same product if sold, as was our previous custom (28,350 lbs. @ 10c per lb.).....	2,835.00
	<hr/>
Cost of sausage and scrapple	\$1,132.48
	<hr/>
Net profit for the year	\$994.01

STATEMENT OF BAKERY FOR YEAR ENDING OCT., 1916.

600,115¾ pounds bread made @ 3½c.....	\$21,004.05
13,012¾ dozen rolls made @ 7c.....	910.89
4,093 pans gingerbread and coffee cake @ 40c.....	1,637.20
Cost of ingredients:	
Cost of materials for bread.....	\$12,799.36
" " " " rolls	417 17
" " " " coffee cake and ginger cake	804.04
Expenses:	
Lard for greasing	101.81
Flour for dusting	259.57
Cost of fuel	240.00
Baker's board	156.00
Wages	835.00
Electric power and light	101.64
Board of patients	312.00
Insurance	3.96
Wear, tear, etc.	600.00
	<hr/>
	\$23,552.14
	<hr/>
	\$16,630.55
	<hr/>
Profit for year ending Oct. 31, 1916.....	\$6,921.59

ANALYSIS OF EXPENSE.

Administrative:	
Medical Director, salary	\$ 4,500.00
Warden, salary	3,500.00
Physicians, salary	8,424.92
Clerical services	7,414.76
Wages	121,326.01
Postage	593.75
Telephone	1,250.92
Telegraph	108.34
Freight and express	99.88
Stationery and office supplies	1,355.76
Traveling expenses—Officers	83.91
Treasurer and Secretary, salary	1,000.00
Sundries	536.10
	<hr/>
	\$150,194.35
Table Supplies:	
Butter	\$ 13,679.63
Bread, crackers, cake, etc.	143.11
Beans	2,523.33
Beef, fresh	19,603.43

Coffee, cocoa, etc.	2,841.84	
Cereals	2,070.06	
Cheese	1,830.12	
Canned goods	460.05	
Eggs	8,933.18	
Fruit, fresh and dried	4,785.42	
Flour	15,264.98	
Fish	3,707.99	
Ham	6,447.32	
Lamb and mutton	4,279.60	
Lard	1,383.62	
Milk	2,715.76	
Molasses and syrup	134.53	
Oysters and clams	1,334.19	
Other meats	2,356.14	
Peas	120.50	
Potatoes, white and sweet	3,547.50	
Pork, salt	672.30	
Poultry	1,553.72	
Rice	770.25	
Spices, pickles, etc.	966.42	
Sugar	8,281.51	
Tea	1,225.28	
Vegetables	1,322.93	
Sundries	500.00	
		113,854.71
House Supplies:		
Beds and bedding	\$ 6,578.54	
Brooms	524.76	
Brushes ..	130.35	
Carpets, rugs, etc.	2,145.36	
Crockery and glassware	774.60	
Cutlery	374.16	
Furniture and upholstery	1,108.90	
Kitchen furnishings	2,342.03	
Laundry supplies, soap, etc.	1,923.39	
Soap, toilet	2,444.32	
Towels, toweling, etc.	1,117.36	
Table linen	863.85	
Woodenware, baskets, pails, etc.	461.46	
Sundries	793.19	
		21,582.27
Clothing and Clothing Material:		
Boots	\$ 95.04	
Clothing	3,875.58	
Dry goods for clothing, etc.	3,343.57	
Furnishing goods	501.80	
Rubber boots and rubbers	23.76	
Hats, caps, etc.	223.31	
Shoes and slippers	3,459.88	
Sundries	10.50	
		11,533.44
Repairs:		
Brick	\$ 110.00	
Doors, sash, etc.	216.02	
Electrical work and supplies	1,597.59	
Glass	102.36	
Hardware	737.74	
Lumber	2,424.87	

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Lime, cement, plaster, etc.	1,757.14	
Machinery, tools, etc.	248.04	
Paint, oil, etc.	834.19	
Plumbing, steamfitting, etc.	2,820.48	
Roofing and materials	2,099.85	
Sundries	11,594.18	
		<hr/> 24,542.46
Farm, Stable and Grounds:		
Blacksmith supplies	\$ 368.28	
Carriages, wagons, repairs, etc.	3,304.88	
Cows	625.00	
Fertilizers, vines, seeds, etc.	3,468.88	
Hay, grain, etc.	12,902.42	
Harness and repairs	139.10	
Horses	565.00	
Pigs	285.00	
Tools, farm machinery, etc.	726.10	
Sundries	1,245.58	
		<hr/> 23,630.24
Heat, Light and Power:		
Coal	\$ 23,878.47	
Electric	7,172.61	
Gas	36.74	
Oil	1,469.04	
Sundries	235.35	
		<hr/> 32,792.21
Miscellaneous Expenses:		
Advertising	\$ 395.53	
Entertainments	549.12	
Funeral expenses	841.00	
Insurance	2,919.94	
Medical supplies	6,152.23	
Newspapers and magazines	228.25	
Religious services	190.00	
Returning runaways	45.40	
Tobacco	1,141.09	
Wines and liquors	302.37	
Sundries	993.91	
		<hr/> 13,758.84
Refund:		
Private patients	1,918.32	
Research work	2,319.22	
		<hr/> \$396,126.06

Treasurer's Report

To the Managers of the New Jersey State Hospital at Trenton:

Gentlemen:—The following abstract of receipts and disbursements for the fiscal year ending October 31, 1916, is respectfully submitted:

RECEIPTS.

Balance Nov. 1, 1915	\$ 26,529.73
From State of New Jersey for maintenance of county patients, for support and clothing for State indigent patients and for support and clothing for convict patients	216,201.55
From sundry counties for county patients.....	123,911.31
From private patients	45,338.81
From sale of sundries.....	6,976.62
From bank for interest.....	95.51
From State Treasurer for officers' salaries.....	17,328.53
	<u>\$436,382.06</u>

DISBURSEMENTS.

For maintenance expenses	<u>\$364,857.59</u>
Balance November 1, 1916	\$71,524.47

H. H. JOHNSON,
Treasurer.

We hereby certify that we have examined the Treasurer's accounts of the New Jersey State Hospital at Trenton and find them correctly stated and balance according to the foregoing statement.

JOS. H. MOORE,
WILLIAM L. BLACK,
Auditing Committee.

NEW JERSEY STATE HOSPITAL

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SUMMARY FOR ANNUAL REPORT OCT. 31, 1916.

	Counties.	Private Patients.	Sundries.	State New Jersey.
November	9,296.01	2,389.51	264.11	16,842.72
December	21,553.38	2,114.58	80.13	16,610.87
January	4,436.79	6,132.15	107.29	16,759.72
February	7,677.67	2,659.75	279.69	17,409.15
March	18,470.25	2,218.88	1,340.49	16,657.43
April	4,856.92	6,489.64	624.55	17,688.14
May	9,563.10	2,220.05	578.77	16,594.71
June	8,024.45	2,653.78	123.20	17,028.01
July	9,035.27	6,982.85	1,492.52	16,948.29
August	9,406.37	2,416.94	445.44	21,466.01
September	14,489.96	2,062.64	423.51	21,505.60
October	7,101.14	6,998.04	1,216.92	20,690.90
	<hr/>	<hr/>	<hr/>	<hr/>
	123,911.31	45,338.81	6,976.62	216,201.55

	Salaries.	Bank Interest.	Disbursements.
November	\$1,316.63		\$26,627.95
December	1,362.46		37,528.19
January	1,408.29		30,488.42
February	1,408.29		29,652.49
March	1,408.29		35,794.34
April	1,362.46		25,236.13
May	1,454.12		28,731.78
June	1,554.10	\$60.43	30,043.05
July	1,570.77		22,847.59
August	1,466.60		17,836.51
September	1,508.26		33,116.92
October	1,508.26	35.08	46,954.22
	<hr/>	<hr/>	<hr/>
	\$17,328.53	\$95.51	\$364,857.59

Statistical Appendix to the Medical Directors' Report

1. General Statistics for the Year.

	Males	Females	Totals
Patients in Hospital November 1, 1915.....	584	771	1605
Admitted within the year.....	885	276	651
Viz: By commitment.....	844	240	594
By voluntary commitment.....	28	24	47
From escape.....	3	0	3
* From visit.....	15	12	27
Whole number of cases within the year.....	1219	1047	2266
Dismissed within the year.....	323	255	578
Viz: Discharged within the year as recovered at time of leaving hospital.....	112	83	195
As capable of self support.....	24	7	31
As improved.....	42	20	62
As not improved.....	18	12	25
Died.....	100	104	204
Escaped.....	5	1	6
On visit.....	27	28	55
Patients remaining in Hospital November 1, 1916.....	806	792	1698
Viz: As indigent patients.....	694	768	1397
As private patients.....	69	82	151
Convict.....	44	2	46
Criminal.....	89	5	94
Number of different persons within the year.....	1219	1047	2266
Number of different persons admitted.....	885	276	631
Daily average number of patients.....	850	780	1648

* 15 males and 12 females nominally admitted for discharge.

2. Insane Received on First and Subsequent Commitments.

	Males	Females	Totals
First.....	324	234	558
Second.....	52	23	60
Third.....	9	0	9
Fourth.....	1	1	2
Fifth.....	1	0	1
Eighteenth.....	0	1	1
Total cases and total persons.....	367	264	651
Never before in any hospital.....	324	234	558

3. Nativity and Parentage of Insane Persons First Admitted to Any Hospital.

PLACES OF NATIVITY	MALES			FEMALES			TOTALS		
	Pa- tients	Fath- ers	Moth- ers	Pa- tients	Fath- ers	Moth- ers	Pa- tients	Fath- ers	Moth- ers
United States.....	1	4	3	1	26	30	2	30	1
New Jersey.....	135	76	71	105	54	65	241	130	136
New England States.....	4	1	4	0	3	0	4	4	4
Middle Atlantic States.....	51	38	37	34	26	18	85	64	55
Southern States.....	16	14	12	8	7	6	24	21	18
Other States.....	10	3	7	3	1	1	13	4	8
Totals.....	217	136	134	152	117	120	369	253	254
Other Countries—									
Austria.....	8	5	6	10	9	9	18	14	15
Bohemia.....	0	1	0	0	0	0	0	1	0
Bahama Islands.....	1	2	2	0	0	0	1	2	2
Budapest.....	1	1	1	0	0	0	1	1	1
Canada.....	1	1	1	0	0	0	1	1	1
China.....	1	1	1	0	0	0	1	1	1
Denmark.....	2	2	2	1	1	1	3	3	2
England.....	6	14	13	9	14	12	15	28	25
France.....	1	2	2	3	3	3	4	5	5
Germany.....	13	24	21	8	20	15	16	44	36
Hungary.....	21	17	13	10	11	11	31	28	24
Ireland.....	6	20	22	18	24	29	24	44	51
Italy.....	16	15	17	8	9	9	24	24	26
Jamaica.....	0	1	0	0	0	0	0	1	0
Mexico.....	1	0	0	0	0	0	1	0	0
Newfoundland.....	1	0	1	0	0	0	1	0	0
Norway.....	0	0	0	1	1	1	1	1	1
Poland.....	4	5	5	3	2	2	7	7	7
Russia.....	12	10	9	6	8	7	18	18	16
Scotland.....	3	3	3	0	1	0	3	4	3
Sweden.....	1	1	1	0	1	1	1	2	2
Switzerland.....	1	1	2	0	0	0	1	1	2
Turkey.....	0	0	0	1	1	1	1	1	1
Total Foreign.....	100	126	118	73	105	101	173	231	219
Unknown.....	7	62	72	9	12	13	16	74	85
Totals.....	324	324	324	234	234	234	558	558	558

4. Probable Cause of Mental Disease in Persons Admitted to This Hospital.

EXCITING CAUSES	ADMITTED		
	Males	Females	Totals
A—PHYSICAL			
Alcohol	79	13	92
Alcohol and other causes	20	4	24
Arteriosclerosis	23	12	35
Brain tumor	1	0	1
Childbirth	0	8	8
Constitutional inferiority	23	23	56
Constitutional inferiority and other causes	18	14	32
Drugs	7	4	11
Epilepsy	4	3	7
Ill health	13	16	29
Imbecility	3	1	4
Masturbation	1	0	1
Menopause	0	11	11
Senility	13	10	23
Senility and other causes	13	18	31
Stroke	1	0	1
Syphilis	51	9	60
Trauma	3	3	11
Focal infection	7	14	21
Gas poisoning	1	0	1
Exhaustion	0	2	2
B—MENTAL			
Domestic troubles	1	14	15
Faulty environment	2	0	2
Fright	1	1	2
Grief	1	4	5
Overwork	5	8	13
Worry	13	23	36
Prison confinement	4	1	5
Heat	1	0	1
Unknown	49	43	92
Totals	307	264	571

FORM OF MENTAL DISEASE	COMMITTED			DISCHARGED																
				Recovered			Capable of Self-Support			Improved		Not Improved		Died		Aggregates				
	Male	F.	Tot.	Male	F.	Tot.	Male	F.	Tot.	Male	F.	Tot.	Male	F.	Tot.	Male	F.	Tot.		
B—PRESERVATION OF MENTAL ADJUSTMENT.	8	26	34	12	7	19	0	0	0	3	3	0	0	0	0	10	20	46	66	
	3	3	6	3	1	4	0	0	0	1	0	1	0	0	0	0	9	13	22	
	6	28	34	1	11	12	0	0	0	2	2	1	0	1	1	2	11	41	52	
	1	2	3	1	1	2	0	0	0	0	0	0	0	0	0	1	2	4	6	
	0	3	3	0	1	1	0	1	1	0	0	0	0	0	0	5	0	10	10	
	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3	
	0	2	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	
	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	1	
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	13	9	22	0	2	2	1	0	1	1	1	1	0	1	1	3	16	14	30	
	47	32	79	0	3	3	4	2	6	8	4	12	1	5	6	13	22	78	128	
	C—NEUROTIC DEFECTIVE.																			
	0	2	2	4	1	5	0	0	0	0	0	0	0	0	0	0	1	4	4	8
	6	6	12	0	0	0	0	0	0	2	2	1	2	3	1	2	4	10	11	21
	15	5	20	0	3	3	0	0	0	8	1	1	0	1	1	0	2	24	12	36
9	10	19	0	0	0	2	0	2	2	0	3	0	1	1	3	5	17	13	30	
2	0	2	1	0	1	0	0	0	0	0	1	0	0	0	0	1	3	2	5	
1	1	2	1	4	5	0	0	0	1	1	0	0	0	0	0	0	2	5	7	
2	9	11	0	6	6	0	0	0	0	0	0	0	0	0	0	1	2	16	18	
0	6	6	0	6	6	0	0	0	0	0	0	0	0	0	0	0	0	12	12	
3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18	8	26	8	2	10	1	0	1	4	2	6	1	1	2	0	2	31	15	46	
Totals.....																				
149	154	304	31	49	80	16	3	19	31	13	33	5	10	15	21	43	64	232	504	
324	234	558	96	70	166	22	4	26	37	19	56	12	11	23	32	93	185	531	1013	

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5 (B). Form of Mental Disease in Patients Committed, Discharged, With Their Condition on Discharge, or Died.

FORM OF MENTAL DISEASE	COMMITTED			DISCHARGED										Aggregates	
				Recovered			Capable of Self-Support			Improved					
	Male	Fe.	Total	Male	Fe.	Total	Male	Fe.	Total	Male	Fe.	Total	Male	Fe.	Total
ALL OTHER ADMISSIONS.															
A—ORGANIC BRAIN DISORDERS.															
Alcoholic dementia	1	0	1	0	0	0	0	0	0	0	0	0	0	3	4
Habitual drunkard	1	1	2	0	0	0	0	0	0	1	0	1	0	4	7
Delirium tremens	5	2	7	0	0	0	0	0	0	0	0	0	0	4	11
Alcoholic paranoid condition	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1
2-Drug Psychosis—	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
Drug habits (morphine, etc.)	7	3	10	6	1	7	0	0	0	0	0	0	0	5	10
	3	1	4	0	1	1	0	0	0	0	0	0	0	2	5
	3	1	4	1	0	1	0	0	0	0	0	0	0	1	5
	2	1	3	1	1	2	0	0	0	0	0	0	0	3	5
	2	0	2	1	0	1	0	0	0	0	0	0	0	0	3
	0	1	1	0	2	2	0	0	0	0	0	0	0	3	3
	10	35	45	9	5	14	0	0	0	1	0	1	0	24	63
	1	2	3	1	0	1	0	0	0	0	0	0	0	2	4
	2	2	4	0	0	0	0	0	0	0	0	0	0	2	2
	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1
	1	1	2	0	1	1	0	0	0	0	0	0	0	1	1
	6	8	14	4	2	6	0	0	0	0	0	0	0	8	14
	0	1	1	0	1	1	0	0	0	0	0	0	0	2	2
	4	6	10	0	1	1	0	1	1	0	0	0	0	3	6
	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	2	3	5	0	0	0	0	0	0	0	0	0	0	1	1
	0	1	1	0	1	1	0	0	0	0	0	0	0	1	1
	1	4	5	0	0	0	0	0	0	2	1	0	0	3	7
	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
	1	3	4	1	1	2	0	0	0	0	0	0	0	2	5
	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1
	0	4	4	0	0	0	0	0	0	1	1	2	0	3	6
	20	38	58	8	8	16	2	3	5	4	1	5	0	87	72
	204	631	835	112	83	195	34	7	41	43	20	62	12	204	491
	112	117	229	53	54	107	24	7	31	38	20	58	12	104	204

6. Causes of Death and Form of Mental Diseases in Persons Who Died.

NEW JERSEY STATE HOSPITAL

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CAUSES	Aggregates			Senile Dementia			General Paralysis			Delirium			Manic Depressive Insanity			Dementia Praecox			Imbecility			Epilepsy		
	Ma.	Fe.	To.	Ma.	Fe.	To.	Male	Fe.	Total	Male	Fe.	Total	Male	Fe.	Total	Male	Fe.	Total	Male	Fe.	Total	Male	Fe.	Total
General Diseases—																								
Tuberculosis	5	9	14	0	1	1	0	0	0	2	0	0	2	1	1	2	2	5	7	0	1	0	1	1
General toxemia	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
Septicæmia	0	2	2	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	
Diseases of the Nervous System—																								
General paralysis	25	7	32	0	0	0	25	7	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Brain tumor	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	
Cerebral softening	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cerebral hemorrhage	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Status epilepticus	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Cerebral apoplexy	48	8	12	2	8	10	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	
Diseases of the Circulatory System—																								
General arteriosclerosis	6	6	12	6	5	11	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	
Myocarditis	7	3	10	4	1	5	0	0	0	0	0	0	2	2	4	0	0	0	0	0	0	0	0	
Chronic myocarditis	9	12	21	3	7	10	0	0	0	1	0	0	2	4	6	2	1	3	1	0	0	0	0	
Organic heart disease	2	1	3	2	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	
Dilatation of heart	3	2	5	1	0	1	0	0	0	1	0	1	0	1	0	0	1	0	0	0	0	1	1	
Endocarditis	2	3	5	1	2	3	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	
Respiratory System—																								
Broncho pneumonia	11	16	27	8	10	18	1	1	2	0	1	1	0	1	1	2	2	4	0	1	0	0	0	
	4	8	12	0	2	2	1	0	1	1	0	1	0	5	5	1	1	2	0	0	1	0	1	
	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5	4	9	5	2	7	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	
	2	1	3	0	0	0	0	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	
	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
Totals	88	87	175	32	42	74	27	5	35	7	6	13	5	16	21	13	10	23	3	2	5	1	3	4

dittis, 1 male; broncho-
latation, 1 male.
disease, 1 male;
mat, 1 male; pulmonary
ionia, 1 male; broncho-
ale; broncho-pneumonia,
male.
male; pulmonary tuber-

dila-
tu-
nale;
gen-
s, 1
female.
Unclassified, acute myocarditis, 1 male; pulmonary tuber-
culosis, 1 female

NEW JERSEY STATE HOSPITAL

Voluntary Commitments.

NAME	SEX	DIAGNOSIS	Duration of Psychosis	Time in Hospital	Date of Discharge	Condition on Discharge
J. M.	Male	Acute alcoholic hallucinosis.	5 days	1 month	May 20, 1916	Recovered
J. W.	Male		1 week	11 days	July 11, 1916	Recovered
J. G.	Male		2 years	3 months	Sept. 2, 1916	Improved
J. S.	Male		1 yr., 6 mos.	21 days	May 14, 1916	Improved
G. E. R.	Male		6 years	7 months, 11 days	Oct. 31, 1916	Died
J. T. R. N.	Male		2 years	6 months		
A. E. N.	Male		4 weeks	6 months		
C. W. A.	Male	General paralysis.	2 weeks	1 day		
H. B.	Male	Subacute alcoholic intoxication.	1 year	1 day		
C. M. C.	Male	Acute alcoholic intoxication.	2 years	2 months, 2 days	July 18, 1916	Recovered
B. B. C.	Male		1 year	3 months	Mar. 15, 1916	C. S. S.
R. S. E.	Male		5 days	1 month, 15 days	April 15, 1916	Recovered
A. B. W.	Male		1 week	1 month	June 14, 1916	Recovered
C. T. K.	Male		2 years	1 year		
L. S.	Male		1 year	6 months		
P. T. R.	Male		5 yrs., 6 mos.	9 months	Oct. 15, 1916	Died
H. B. C.	Male		2 years			
J. W. M.	Male		6 years			
E. C. S.	Male		1 month			
R. O. B.	Male		7 months			
E. M. B.	Female		6 months			
Y. W. P.	Female		1 yr.	11 days	Dec. 31, 1915	Improved
P. E. P.	Female		5 weeks	4 months, 19 days	April 29, 1916	Recovered
I. S. F.	Female	Senile dementia.	1 week	4 months, 5 days	Oct. 25, 1916	Died
A. W.	Female		5 years	7 months, 7 days	Oct. 25, 1916	Unimproved
A. N. W.	Female	Progressive muscular atrophy	2 years	1 day	Aug. 22, 1916	Unimproved
M. H. P.	Female		6 months	4 months, 4 days	Oct. 28, 1916	Improved
E. P. P.	Female		1 year	24 days	June 18, 1916	Improved
I. B. P.	Female		2 years	8 months	July 30, 1916	Recovered
R. O. P.	Female		5 months	8 months	July 27, 1916	Recovered
A. O.	Female		2 weeks			
S. L. E. H. O.	Female		1 month			
J. E. H. O.	Female		2 months	3 months, 12 days	Oct. 29, 1916	Improved
C. M. D.	Female		7 yrs., 4 mos.	1 month, 15 days	May 8, 1916	Recovered
W. L. D.	Female		3 weeks	4 months	Aug. 22, 1916	Improved
R. M.	Female		Unknown	10 days	July 27, 1916	Recovered
A. M. E. H.	Female		10 years	4 months, 6 days	May 23, 1916	Unimproved
E. R.	Female		5 years	1 month, 23 days	Aug. 29, 1916	Recovered
M. W. M.	Female		1 day	1 month, 5 days	July 10, 1916	Unimproved
E. P.	Female		16 years	3 months, 30 days	Oct. 8, 1916	Unimproved
			Unknown			

Document No. 52

Forty-First Annual Report
OF THE
MANAGERS AND OFFICERS
OF THE
New Jersey State Hospital
AT MORRIS PLAINS

For the Year ending October 31st, 1916

FORTY-FIRST ANNUAL REPORT
OF THE
MANAGERS AND OFFICERS
OF THE
NEW JERSEY STATE HOSPITAL
AT
MORRIS PLAINS

For the Year Ending October 31st
1916

HOSPITAL PRINT
1917

ADMINISTRATION BUILDING

Managers

PRESIDENT

PATRICK J. RYAN.....Elizabeth

VICE-PRESIDENT

ALBERT RICHARDS.....Dover

JOHN C. EISELE.....Newark

JOHN T. GILLSON, M. D.....Paterson

JOHN NEVIN, M. D.....Jersey City

W. L. R. LYND.....Dover

CHARLES E. HETZEL.....Newark

DANIEL S. VOORHEES.....Morristown

Officers

MEDICAL DEPARTMENT

BRITTON D. EVANS, M. D.....	Medical Director
E. MOORE FISHER, M. D.....	Senior Assistant Physician
LOUIS K. HENSCHER, M. D.....	Senior Assistant Physician
GEORGE A. ANDERTON, M. D.....	Assistant Physician
MARCUS A. CURRY, M. D.....	Assistant Physician
GEORGE R. HAMPTON, M. D.....	Assistant Physician
GEORGE B. McMURRAY, M. D.....	Junior Assistant Physician
FRANK M. MIKELS, M. D.....	Pathologist
H. ANDREW WALLHAUSER, M. D.....	Junior Assistant Physician
ELAM F. SRYGLEY, M. D.....	Junior Assistant Physician
ANNIE F. COLLEY, D. D. S.....	Resident Dentist

BUSINESS DEPARTMENT

O. M. BOWEN	Warden
EDWARD I. COURSEN	Assistant Warden
HARRISON P. LINDABURY.....	Treasurer
HENRY W. BUXTON.....	Secretary

Board of Consultants

JAMES T. WRIGHTSON, M. D.....	Physician
JOSEPH BRETTAUER, M. D.....	Gynecologist
PHILANDER A. HARRIS, M. D.....	Gynecologist
JOSEPH FEWSMITH, M. D.....	Neurologist
CHRISTOPHER C. BELING, M. D.....	Neurologist
FRANCIS H. GLAZEBROOK, M. D.....	Surgeon
JEROME MORLEY LYNCH, M. D.....	Surgeon
CLIFFORD MILLS, M. D.....	Surgeon
LEONIDAS L. MIAL, M. D.....	Eye, Ear, Nose and Throat
E. BLAIR SUTPHEN, M. D.....	Eye, Ear, Nose and Throat
H. J. F. WALLHAUSER, M. D.....	Dermatologist
HARRISON S. MARTLAND, M. D.....	Pathologist
CLARENCE R. O'CROWLEY, M. D.....	Urologist
DAVID A. KRAKER, M. D., F. A. C. P.....	Gastro-Enterologist and Proctologist
WILLIAM G. SHARP, D. D. S.....	Dentist

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REPORT OF THE BOARD OF MANAGERS

Report of the Board of Managers

To His Excellency, James F. Fielder,

Sir : This, the forty-first annual report of the Board of Managers of The New Jersey State Hospital at Morris Plains, covering the year from November 1st, 1915, to October 31st, 1916, is respectfully submitted.

As in previous years the reports of the Medical Director and the Warden are incorporated into the report of the Board of Managers, in order to set forth in detail the affairs of the medical and business departments.

The Medical Director's report notes the changes in population and embodies a condensed statement of the more important phases of the work accomplished in the medical department.

During the year 3,265 patients were under treatment—1,635 men and 1,630 women. The highest number under treatment at any one period during the year was 2,737. There were 596 patients admitted—300 men and 296 women.

On October 31st, 1916, there remained in the hospital 2,688 patients—1,332 men and 1,356 women, showing a permanent increase in population of 19. The unusually small addition is due largely to decreased immigration affecting the number of admissions and the transfer of 52 patients to the New Jersey State Village for Epileptics at Skillman.

There were discharged during the year 577 patients—303 men and 274 women ; of these, 46 men and 48 women were restored to their former mental health. Two hundred and forty patients died—132 men and 108 women.

The Warden's report sets forth the hospital finances. It also contains much detail information concerning the affairs of the business department. The report as submitted is an abridgment of his complete report, statistics concerning farm and garden products and the work done in the various shops having been

omitted as not essential to an official document of this kind. The complete report has been made a matter of permanent record and subject to reference.

EFFECTS OF ADVANCED PRICES.

The great advance in the cost of all forms of commodities which are necessities in the matter of the maintenance of patients in this hospital presents a most serious problem to the managers and officers. Many of such commodities have advanced from fifty to two hundred percent., but the amount of food necessary to maintain life and the amount of clothing demanded to give comfort of body and guard the health of patients has not decreased. The assistance given by the State is far from being proportionate to the financial demands made upon the hospital through this rise in prices.

The older the institution becomes the greater is the number of repairs necessary to keep it in proper running order and in respectable condition. When prices were lower for food, clothing, material and labor, the managers through strict economy and a careful supervision of the hospital finances were able to keep up a large percentage of the ordinary repairs and replacements. With market conditions as they are to-day, it is found to be difficult to keep the standard of maintenance and repairs up to such a point as to meet the actual demands of the situation and the expectations of the public at large.

Laws enacted in the last two or three years have been of such a technical character that the managers have found themselves unable to meet unavoidable emergencies. In every department of the hospital affairs the cost of labor has advanced from thirty to one hundred percent. This applies to skilled workmen, farmhands, laborers in the various industrial departments and to nurses and attendants, and even with the advanced pay which it has been found necessary to give, the officers have not been able to obtain sufficient help to guarantee that order of safety and welfare of the house and its inmates which the public naturally and reasonably expects and demands.

Except there be some modifications of our laws governing

maintenance, and they are made sufficiently flexible to meet actual emergencies, the sick must suffer, and neither the managers nor the officers of the institution can reasonably or justly be held responsible.

THE NEW BUDGET LAW.

This law may have many good phases, but it requires the officials of the institution to make an estimate fifteen months ahead as to the moneys necessary for the various orders of maintenance, supplies, repairs and replacements.

It does not require a high-grade financier to understand that this involves a foresight greater than the ordinary official possesses. If the great financiers of the world could command that order of projective judgment it would result in their accumulating untold wealth.

Afflicted humanity is sent to this hospital by order of the various courts. It becomes the duty of the managers to see that they are humanely treated and as considerately cared for as the means provided will permit. They cannot do more, and it would seem from the standpoint of justice to the cause represented by the establishment and maintenance of institutions for the insane, that there should be such flexibility in our statutes as would guarantee, under economical and careful management, that order of treatment, care and protection which this class of our afflicted fellow-citizens are entitled to under the accepted laws of humanity.

Some provisions should be made that will permit the setting aside of the rigid technical interpretation of our laws when hunger is threatened, when heat, light and clothing are needed without delay. It would seem that the Budget Law should require a list of commodities necessary, and make provision accordingly, rather than the amount of money needed, so that a rise or fluctuation in the cost of running or properly maintaining an institution such as this would not place the health and comfort of the sick in serious jeopardy.

IMPROVEMENTS.

The improvements authorized during the past year have been given careful attention. Most of them are completed; the re-

mainder are receiving due and studious consideration and are steadily progressing.

NEEDS OF THE HOSPITAL.

A schedule of the wants and needs of the institution has, in conformity to the Budget Law, been presented to the Governor. It could not be made full and comprehensive, nor could it be so prepared as to foresee and specifically determine numerous items which will unavoidably present themselves during the year it is to cover. The following is a list of the most essential needs of the institution :

Additional Equipment for Diversional Occupation Department—Industrial Building.
Additional Shower Baths.
Fireproof Vault and Filing Cabinets—Medical Department.
Elevator for Laundry.
Machinery for Mechanical Departments.
Settees and Benches for Lawns.
Flooring Material—Wards of Administration Building.
Equipment of Barber Shop.
Painting Materials.
Furniture and Carpets.
Material for Rebuilding Hennergy.
Lumber, Lime, Cement, Etc., for Repairs.
To Remedy Defects in Water Main, Valves, Elbows, Etc.—
High Service Reservoir Line.
Railroad Equipment.
Gas Plant—Retorts, Etc.
Sewage Disposal.
Fixtures and Materials for Lighting Industrial Rooms—Dormitory Building.
For Replacement of Isolated Steam Driven Units by Electric Motors Operated from Central Power Plant.
Roads.
Hose, Fire Extinguishers, Nozzles, Etc.
Reservoir Dam.
Water Main for Garden, Greenhouse, Piggery and Hennergy.
Refrigeration for Dormitory Building.
Iron Fence.
Wire for Fencing.
Necessary Addition and Equipment for Mortuary Building.

Material for Coal Trestle.
Bungalows (3) for Married Physicians.
Building, Sterilizing Equipment, Etc.—Dairy.
Material for Root Cellar.
Shop Building.
Building, Pump, Etc., for Artesian Well.
Slaughter House and Equipment.
Lodge House and Gate, Main Entrance.
Material for Hospital Garage.
For Research Work—Eugenic Department.
For the Annual Appraisement.
For Traveling Expenses of Board of Managers.
For Insurance Premiums.
Books and Bookcases for Patients' Circulating Library.
Indoor Amusement Fund, Rental of Films for Motion
Picture Shows, Vaudeville and Entertainments for Special
Holidays.
Auto Trucks—Medical Department.
Additional Dental Equipment.
Outdoor Amusement Fund.
For Completion of Golf Course and Amusement Grounds
for Patients.
Special Photographic Supplies and X-Ray Plates.
Supplies for Pathological Department.
Vacuum Cleaners.
Wireless Time Receiving Apparatus.

COUNTY INSTITUTIONS.

Under Chapter 167 of the Laws of 1916, the duty of inspection of the county institutions was transferred from the Boards of Managers to the Commissioner of Charities and Corrections. There is, therefore, no report to be made concerning these institutions.

VISITS.

On December 15th, 1915, Hon. James F. Fielder, Governor, accompanied by his Secretary, Mr. Edward Hermann and Mr. John Headen, made an official visit and inspection.

Other visits were made by gentlemen who exhibited distinct interest in the welfare of the institution and its work. Some of

them, officially connected and directly concerned, made inspections as State officials; others were prompted by philanthropic and humanitarian motives. Among them were:

Hon. C. L. Morgan, Assemblyman of Union County.

Hon. James C. Connolly, Judge of the Court of Common Pleas of Union County.

Hon. Richard Stockton, Commissioner of Charities and Corrections.

Hon. Edward E. Grosscup, State Purchasing Agent.

Mr. C. L. Stonaker, Secretary of the State Charities Aid and Prison Reform Association.

Dr. Thomas W. Salmon, Medical Director of the National Committee for Mental Hygiene.

Rev. James M. Buckley, Ex-President of the Board of Managers, with Rev. George P. Mains, of the Methodist Book Concern, of New York.

Mr. John J. Nevin, Auditor of the State Comptroller's Office.

The Joint Appropriation Committee of the Senate and the Assembly visited the hospital on January 21st, 1916.

The members of the Board of Managers, as shown by the official register, attended the twelve regular meetings and twenty-five special meetings. They also made ninety-seven visits on occasions when there was no official call for a Board meeting. Collectively, the records show a total of one hundred and ninety-three visits made by the various members of the Board of Managers during the year.

CONCLUSION.

The affairs of the hospital have been conducted throughout the year without any grave accident or disaster, notwithstanding the overcrowded condition of the institution and the inability to secure the services of sufficient nurses and other help, which to this Board signifies much watchfulness and fidelity on the part of the resident officers and their subordinates.

The year's work, under the many unfavorable problems presented and the discouraging conditions confronted, entailed upon all directly concerned in the institution's welfare much anxiety, hard work and mental strain. We desire to make appreciative acknowledgment of the manner in which the officers and employees have performed their respective duties.

Respectfully submitted,

P. J. RYAN, President.

ALBERT RICHARDS, Vice-President.

JOHN C. EISELE.

J. T. GILLSON, M. D.

JOHN NEVIN, M. D.

W. L. R. LYND.

CHARLES E. HETZEL.

DANIEL S. VOORHEES.

October 31st, 1916.

REPORT OF THE MEDICAL DIRECTOR

Report of the Medical Director

To the Board of Managers,

Gentlemen: The laws of the State of New Jersey require that a report from the various institutions of the State be submitted to the Governor and the legislature each year. Pursuant to such law, I beg to submit this report of the affairs and work of the medical department of this institution for the year beginning November 1, 1915, and ending October 31, 1916. This is the forty-first annual report of the medical department, and is submitted so that it may be incorporated into your report and therein set forth the more pertinent facts bearing upon the custodial and scientific care of the insane, with statistics relating thereto.

The past year has shown a gradual but steady increase in the patient population of the institution. The congestion and overcrowding, with all its embarrassments, inconveniences and dangers, still exists. No immediate relief is in sight. The problem is daily growing more serious. The State has purchased land in Hunterdon county upon which to build a new institution. While this is a step in the right direction, it does not ameliorate the serious and calamity threatening conditions confronting this hospital in the care of overcrowded rooms and corridors. Again I write in most earnest terms and make a most sincere appeal in behalf of humanity that greater haste be made, that more serious consideration be given in the matter of lessening the dangers arising out of the overcrowding and herding together of patients in an inhumane way. For several years there has been under construction a building for the convict and criminal insane of the State; this building would give some little relief if it were in shape or condition to receive that class of our patients—which number nearly one hundred—but postponement of its completion, wherever the responsibility may lie, gives us much concern.

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REVIEW OF STATISTICS.

ADMISSIONS.

The statistics in this report cover the hospital year—November 1, 1915, to October 31, 1916. Five hundred and ninety-six patients were admitted, ten less than the preceding year when the admissions reached the maximum number since the establishment of the institution. The slight decrease is readily accounted for by the very small immigration to this country owing to the European war and the further fact that Warren county was by an act of the Legislature transferred to the Trenton State Hospital district.

At the close of the year the census of the hospital was 1,332 men, and 1,356 women, a total of 2,688, which is a greater number than in any previous year, and over 1,000 in excess of the normal capacity of the institution.

In January 64 patients were admitted and 40 in October, which are respectively, the highest and lowest months.

Two hundred and eighty-three patients, about 47.5 percent of the total admissions, were alleged to be suffering from their first attack. Those patients in whom the number of attacks was alleged to be two or more were 94 in number; no data was furnished the institution upon this important point in the commitment papers of 219 patients. The lack of this information is in a large measure due to the failure of examining physicians to make such careful inquiry as the importance of the matter demands. There should be statutory requirements guaranteeing fuller data in all medical certificates. Not only is a lack of essential data a detriment to our statistics, but it retards diagnosis, and when the commitment papers are brought before the courts for action, the judges and justices find reason for complaint on the ground that the information is not sufficient to enable them to intelligently make a final order of commitment.

The number of patients where the age at first attack was unascertainable is 277, a larger number than in the preceding year. It seems to be growing more and more difficult each year to obtain essential data regarding the patients admitted. Table IV shows that the largest number in any one subdivision indicating

the first manifestation of mental disorder, was between the ages of twenty-five and thirty years, amounting to 42 patients. During the years of evolution mental breakdown seems most prevalent, as between the ages of fifteen to thirty years the number of patients was 108, or almost 20 percent. of the total number admitted.

The number of native born patients admitted was 331. New Jersey is given as the birthplace of 181, considerably more than half of those recorded as born in the United States. As in previous years, the State of New York gave the next largest number, being the birthplace of 77 patients, or more than half the total number of native born patients admitted exclusive of New Jersey. Eight patients were natives of Pennsylvania, showing that the two principal border States contributed a very large proportion of native born patients. In the cases of all these, legal residence was established to be in New Jersey.

Despite the fact that immigration had been greatly restricted during the period of the conflict in Europe, the foreign born admissions continue to be over 43 percent of the total. Italy was the birthplace of 50 patients, Austria-Hungary of 49, Germany 41, Ireland and Russia 31 each and England 11. It is quite probable that in a number of these cases the unfortunate conditions which prevail in their native countries were potent factors in developing their psychoses.

The classification of patients by the counties from which admitted shows that Hudson County furnished 108 patients, Union County 107 and Passaic County 101: these three counties sending over 53 percent. of all the admissions.

Table VII, giving the civil condition of those admitted, shows that 213 were single, 303 or over 50 percent were married, 64 were widowed, 3 divorced and in 13 the civil status was unascertainable.

Ninety occupations are represented by those admitted, the number engaged in by men being 80 and by women 10. The largest number of men noted in any one occupation was 69—that of laborers. Next in order of number were 21 clerks, 12 farmers and 12 merchants. Of the women 106 were housewives and 97 were assigned to housework. The term "housework" is doubtless used in

many cases where the patients are housewives or domestics, the number of the latter, this year, being but 22. Fifty patients were stated to have no occupation—23 men and 27 women.

The number of patients admitted diagnosed as afflicted with incurable psychoses was 367—about 61.5 percent. Of these, 214 were diagnosed as dementia precox, constituting 35.5 percent of the total. The latter class comes to the institution during the adolescent period of life; their average stay in the hospital is about fifteen years and they form a large proportion of our permanent excess population.

Only two patients suffering from morphinism were admitted during the year, which would indicate that the Harrison law governing the sale of the habit-forming drugs is proving effective.

There were 79 patients admitted showing distinct evidence of abnormal mental excitement. Many patients diagnosed under the other classifications of psychoses were also in an excited mental condition when brought to the institution. Sixty-five were markedly depressed when admitted.

About 10 percent of the admissions were due to syphilitic infection, the Wassermann test being used in connection with the making of a diagnosis of dementia parietic.

The manner of support of the patients admitted during the year shows that 177 were chargeable to the State exclusively, 289 to the State and counties jointly and 130 were supported by either relatives or the patients' estates. Under the new commitment law (Chapter 94, Laws of 1916) the hospital receives no compensation for the support of indigent patients until their legal residence has been judicially determined but provides that such patients be classified temporarily as residents of the counties from which they have been committed.

No cause was given for the psychoses in the commitment papers of 340 patients, more than half of those admitted. Intemperance and other excesses are given as the cause in 47 instances, syphilis in 19, senility in 22 and heredity in 22. The small number in which heredity is assigned as the cause indicates a disposition on the part of relatives to conceal intimate family history. Of the moral causes assigned, worry was given in the cases of 25 patients and religious excitement in 14.

Of the more important physical complications of those admitted, the following merit special note. Syphilis was present in 69 patients, arteriosclerosis in 52, cardio-renal vascular disease in 160. Among those admitted 55 patients exhibited homicidal and 82 suicidal tendencies, showing that almost 25 percent were a menace to others or to themselves at the time of admission.

Heredity in the families of patients was admitted in 113 patients; in 214 it was denied, and in 269 no history could be obtained. The eugenic research workers, however, find considerable hereditary taint in a large number of cases where the commitment papers deny an hereditary history or where it is alleged to be unobtainable.

In almost 50 percent of the patients admitted the duration of mental disease was stated to be less than three months. Forty-four patients give a history of insanity extending over a period of five years. It is unfortunate that relatives do not realize the importance of early institutional care and treatment.

DISCHARGES

During the year 94 patients were discharged as recovered—46 men, and 48 women, a percentage of 15.75 based on the number admitted. Before being discharged these patients were presented at staff meetings and gave satisfactory evidence of a restoration to mental health. Thirty-six were under treatment less than 4 months when discharged and 22 were under treatment over a year. In the latter group there were many who were given diversional occupation in the industrial division and in my opinion such employment of mind aided materially in bringing about recovery.

Fifty-two of the patients who recovered suffered from manic depressive psychoses; 35 of them were of the manic phase, 16 of the depressed phase and 1 of the mixed phase. Intoxication psychoses gave 25 recoveries, dementia precox 11 and involutional melancholia 5.

There were 240 deaths during the year—132 men and 108 women, the percentage being about 7.35 of the total number under treatment. Ninety-six of these patients ranged from 60 to 90 years of age. Many of them were in the institution but a short

time and a number were moribund at the time of admission. Between the ages 35 and 60, 116 died; these include 67 patients afflicted with dementia paretic, a preventable form of mental disease, but incurable.

Cardiac disease was assigned as the physical cause of death of 43 patients, pulmonary diseases 65 and nephritides 29, a total of 137—57 percent of those who died. The death of 51 patients was due to cerebral disease, convulsions being responsible for the death of 21 patients suffering from dementia paretic and 4 from epileptic psychosis.

NEW COMMITMENT LAW.

The Governor appointed a commission to draft a new commitment law to supercede that of 1913. The 1913 law, after a trial of three years, did not prove to be entirely satisfactory, and made the commitment of a patient to an institution a very complicated proposition. The commission appointed by the Governor held a number of meetings, and the results of their efforts is Chapter 94, Laws of 1916, which went into effect July 4, 1916. The main changes in the law from 1913 are as follows:

The patient must be brought to the institution within ten days from the time the physicians examine him, instead of six days, as in the old law.

Voluntary patients may be admitted, both private and indigent. Under the old law, only private voluntary patients could be admitted to the State hospitals.

The Law of 1913 required that the Judge of the Court of Common Pleas in the county wherein the patient resided issue the final court order legalizing commitment after holding an inquiry concerning the patient's mental condition. The law of 1916 requires the Judge of the Court of Common Pleas, with the consent of the freeholders in each county, to designate a Commissioner in Lunacy. This commissioner shall hold inquiries and prepare the papers and final court order for the Judge of the Court of Common Pleas to pass upon. Three months from the time originally set for the hearing, the State hospital wherein the patient is confined must be furnished with the final court order.

PATIENTS ENGAGED IN CONSTRUCTION OF LABORATORY BUILDING

LABORATORY BUILDING FURTHER ADVANCED

Under the 1913 law, it was found difficult for the judge to get the relatives to give necessary information regarding residence of patients and other matters concerning them. It is to be hoped that the appointment (under the law of 1916) of a Commissioner in Lunacy in each county will result in the hospital obtaining a prompt final order legalizing the commitment of patients to the institution, and in that way have all legal requirements incident to the patient's commitment expeditiously decided.

The law of 1916 has now been in operation four months and seems to be working satisfactorily both to the county officials who have charge of the commitment of patients to the institution and to the hospital authorities, giving proper protection to the person to be committed and to the community at large.

PATHOLOGICAL REPORT.

The report of the pathologist has been submitted to the medical director, and the more salient facts are incorporated in this report.

Dr. Frederic H. Thorne terminated his service as resident pathologist on July 1, 1916. The resume of the special research work completed by him after his return from a period of special study in Europe is included in the report of the Pathological Department.

Dr. Frank M. Mikels was promoted to the position of resident pathologist and attended to the duties of this office until November 9, 1916, when he resigned to take up private practice.

The following is a summary of the clinical pathology that has been done during the year ending October 31, 1916:

Examination of:

Blood—

Complete cytology.....	40
Cultures.....	8
For Plasmodium Malaria.....	3
Wassermann tests.....	976
Fixation tests for Gonorrhœa.....	10
Gruber-Widal tests.....	2
Fixation tests for Tuberculosis.....	50
Luetin tests.....	30

Cerebro-Spinal Fluid—	
Cytology	176
Globulin tests.....	176
Wassermann tests.....	191
Colloidal gold tests.....	54
Gastric contents.....	2
Pharyngeal swabs.....	4
Exudates.....	2
Sputum—	
For tubercle bacilli.....	55
Urine—	
Chemical and microscopical.....	728
Water (bacteriological)	40
Urethral Smears—	
For gonococci.....	4
Total	2,551

URINALYSIS.

In the performance of the routine laboratory work exacting attention has been given to the urinalysis of each patient admitted to the hospital, and whenever any of the specimens showed a pathological condition, the findings were carefully correlated with the special treatment prescribed by the ward physician in charge of the patient.

The urinalyses that have been done during the year on newly admitted patients have shown that 117, or 19.63 percent, were afflicted with nephritis. Eighty-three, or 13.92 percent, of these were men and 34, or 5.7 percent, were women.

The following gives the various psychoses in which nephritis was found:

Psychoses:	Men	Women	Total
Intoxication—			
Chronic Alcoholism.....	14	2	16
Exhaustion.....	1	..	1
Dementia Paretic.....	12	3	15
Dementia Organic.....	2	..	2
Arteriosclerotic	2	..	2

Dementia Senile	6	7	13
Dementia Precoc.....	27	9	36
Epileptic.....	3	1	4
Manic Depressive	14	11	25
Arrested Psychical Development—			
Imbecility	2	1	3
Total.....	83	34	117

WASSERMANN TESTS.

Part of the regular routine pathological work included one or more Wassermann tests with the blood serum of each newly admitted patient. Whenever the patient's blood serum gave a positive reaction to this test a specimen of the cerebro-spinal fluid was taken, along with another specimen of blood and both subjected to the same test. Findings in such instances were carefully correlated with the clinical examination and if the clinical picture of the patient's mental disease was not clearly indicative of cerebro-spinal syphilis or dementia parietic, then the positive pathological findings were used advantageously to substantiate the presence of a syphilo-pathy.

Whenever a patient's blood test and history showed evidence of syphilitic infection the cerebro-spinal fluid was immediately put through the regular Wassermann tests and the cell and globulin content determined. Special after care was always given the patients who were submitted to a lumbar puncture and careful observation made of any ill effects and treatment given when any discomfort was manifested. It has been observed in all cases that the patients who were afflicted with dementia parietic never complained of any discomfort following the lumbar puncture, but the patients whose spinal fluid gave a negative reaction to the test usually complained of a slight dizziness, headache and occasionally nausea. A few patients complained of having a peculiar sensation of weight or pressure in the muscles of the shoulders and neck and considerable myalgia.

In addition to doing a Wassermann test on each newly admitted patient a large number of tests were done on patients who had been committed to this hospital before this test had become

a recognized part of our routine pathological work.

The blood of forty-eight patients was not submitted for a Wassermann test as some died shortly after admission and others were among the number having dementia senile and were so advanced in age that it did not seem advisable to do the test.

In the following table is enumerated the number of blood sera and cerebro-spinal fluids that were submitted for Wassermann tests; also the number of positive and negative reactions that were found in the particular psychoses with which these patients were afflicted.

	W. R. BLOOD SERA			W. R. C. SPINAL FLUID		
	Plus	Minus	Total	Plus	Minus	Total
Intoxication Psychosis:						
Chronic alcoholism.....	2	28	30	..	3	3
Morphinism.....	1	2	3	..	1	1
Infection Psychosis.....	1	3	4	..	..	..
Exhaustion Psychosis.....	..	1	1	..	..	..
Syphilitic Psychosis:						
Tabo-Paresis.....	1	..	1	1	..	1
Dementia Paretic.....	57	1	58	54	4	58
Dementia Organic:						
Cerebral trauma.....	..	9	9	..	1	1
	..	1	1	..	..	..
Arteriosclerotic Psychosis.....	..	6	6	..	1	1
Presenile Delusional Psychosis.....	..	5	5	..	1	1
Dementia Senile.....	..	28	28	..	..	..
Dementia Præcox.....	15	198	213	..	18	18
Paraphrenia.....	..	2	2	..	..	..
Paranoia.....	1	..	1	..	1	1
Epileptic Psychosis.....	2	13	15	..	2	2
Manic Depressive Psychosis.....	13	130	143	..	14	14
Involutional Melancholia.....	..	5	5	..	..	..
Psycho-Neurosis:						
Hysterical psychosis.....	..	1	1	..	..	..
	..	1	1	..	..	..
Degeneration Psychosis:						
Sexual perversion.....	..	1	1	..	..	..
Constitutional Inferiority.....	1	4	5	..	1	1
Arrested Psychical Development:						
Imbecility.....	1	15	16	..	1	1
Total.....	94	454	548	55	48	103

INTRASPINOUS TREATMENTS OF DEMENTIA PARETIC.

Twenty-four patients diagnosed as dementia paretic were given intraspinoous injections of salvarsan, neosalvarsan and mercurialized serum. The largest number of treatments given to one patient was twenty, and the smallest number three. This method of treatment was begun two years and six months ago. At the present time the patients who have received these treatments may be classified as follows:

Dead	11
Markedly demented.....	8
Taken home by friends and showing slight improvement	2
Discharged and admitted to another institution.....	1
Remaining in hospital in fairly good mental and physical condition, but showing well defined symptoms of dementia paretic	2
Total.....	24

TREATMENT OF SYPHILIS.

All patients admitted to the hospital during the year who showed symptoms of active syphilis, excepting the cerebro-spinal form, were treated intravenously with mercurialized serum. These treatments were given once a week beginning with one-twelfth of a grain doses. This dose was gradually increased until one-third of a grain was reached. There was no pain or discomfort of any kind following the injections. In our hands, this method of treating syphilis has been very satisfactory.

COMPLEMENT FIXATION TEST FOR TUBERCULOSIS.

Considerable experimenting was done during the year with the complement fixation test for tuberculosis. Antigen was made from several strains of the tubercle bacilli, which were isolated from sputa. These bacilli were grown upon selected media and the resulting antigen and subsequent tests were carried out exactly as it is done in the Wassermann test for syphilis.

AUTOPSIES.

The autopsies performed during the year are as follows:

Number of autopsies.....	25
Sex:	
Men.....	14
Women.....	11
Race:	
White.....	22
Colored.....	3

The average age at death was 52 years and 7 months.

The extremes of age were 31 and 92 years.

The psychoses represented were as follows:

Intoxication Psychosis—	
Chronic Alcoholism.....	1
Dementia Paretic.....	2
Arteriosclerotic.....	2
Dementia Senile.....	6
Dementia Precox.....	9
Manic Depressive.....	4
Arrested Psychical Development—	
Imbecility.....	1
Total.....	<u>25</u>

WATER ANALYSIS.

The responsibility of keeping a careful check on the condition of the water supply was assigned to the medical department in October. Preparations were immediately made for a careful and regular analysis of all water supply. Specimens of the water were taken every two weeks from these sources, and, in addition to this, specimens were taken from the various outlets in the buildings of this institution and examined so that a careful check could be kept on the efficiency of the new purification plants, which were installed during the past year.

CONTINUOUS BATHS, MENS DEPT.

EUGENICS.

Research in the causative factors of insanity is still carried on at this institution, the Misses Mary Clark and Myrtle F. Smart making the investigations under my directions. A detailed report of the eugenic research work done by them has been handed in, and an abstract is given below:

The histories of 147 families have been compiled during the past year, consisting of 32 patients admitted to the hospital the previous year and 124 admitted this year. The 147 histories contain data regarding 5,608 individuals, of whom 4,683 are charted. The records of the eugenic office show that since work was begun in August, 1912, information has been ascertained concerning 20,286 persons connected by some tie of blood or alliance with patients in the hospital.

In the histories of this year, 284 insane are enumerated, a trifle more than 5 percent of the individuals described. This is more than twelve times as much as in the general population, where the incidence of insanity has been estimated as under 4-10 of 1 percent. Other "taint," physical and mental, appears as follows: Suicides, 14; feeble-minded, 26; neurotic, 101; epileptic, 25; alcoholic, 179; syphilitic, 33; sexually immoral, 44; tuberculosis, 100; paralytic, 56; cancerous, 33; blind, 7; deaf and deaf-mute, 11. In compiling these findings every effort has been made to exclude doubtful evidence. For instance; individuals mentally below par who are able to care for themselves without coming in too frequent conflict with the social and moral standards of the community have not been counted as feeble-minded; those attempting self-destruction and failing have not been reckoned among the suicides; only immoderate drinkers were considered alcoholic.

The results of the investigations of heredity have been arranged in groups according to the psychosis of the patient under consideration.

Group I. Dementia Organic: 3 patients; 2 women, 1 man.

2 patients, women, no taint.

1 patient, man; family shows tuberculosis, syphilis, neurotic condition, paralysis and organic dementia.

Group II. Dementia Paretic: 13 patients; 2 women, 11 men.

9 patients, 1 woman, 8 men; brief histories, no taint.

1 patient, woman, no taint in ancestry or fraternity; child epileptic; (husband's connections show alcoholism, epilepsy and insanity).

1 patient, man, alcoholism in both sides of ancestry.

2 patients, men, alcoholism, tuberculosis, immorality and insanity in family.

Group III. Dementia Precox: 65 patients; 28 women, 37 men.

Paranoid: 32 patients; 9 women, 23 men.

11 patients, 2 women, 9 men, brief histories, no taint.

4 patients, 3 women, 1 man, considerable information, no taint.

2 patients, men, taints of alcoholism, neurotic condition, tuberculosis and paralysis present in family, but no gross mental disorder.

2 patients, men, heredity shows epilepsy, but no insanity.

13 patients, 4 women, 9 men, insanity in family variously combined with other taints.

Hebephrenic: 18 patients; 9 women, 9 men.

5 patients, 1 woman, 4 men, brief histories, no taint.

5 patients, 3 women, 2 men, neurotic condition in family, but no gross mental disturbance.

8 patients, 5 women, 3 men, insanity in ancestry or fraternity variously combined with other taints.

Katatonic: 9 patients; 7 women, 2 men.

4 patients, 3 women, 1 man, brief histories, no taint.

1 patient, neurotic condition and tuberculosis in family, but no gross mental disturbance.

4 patients, 3 women, 1 man, insanity in family.

All Other Types: 6 patients; 3 women, 3 men.

3 patients, 2 women, 1 man, brief histories, no taint.

1 patient, woman, considerable information, no taint.

1 patient, man, brief history, trace of insanity in collaterals.

1 patient, man, alcoholism and neurotic condition in family.

Group IV. Dementia Senile: 10 patients, 4 women, 6 men.

2 patients, men, brief history, no taint.

1 patient, man, tuberculosis, paralysis and neurotic condition present in family.

1 patient, man, no taint in ancestry, epilepsy in child.

5 patients, 3 women, 2 men, insanity in family.

Group V. Arrested Psychical Development—Imbecility: 7 patients; 3 women, 4 men.

2 patients, men, brief histories, no taint.

1 patient, man, no taint, psychoses apparently due to scarlet fever.

1 patient, woman, neurotic condition in family.

1 patient, woman, feeble-mindedness among family connections.

2 patients, 1 woman, 1 man, insanity.

Group VI. Involutional Melancholia: 2 patients; 1 woman, 1 man.

1 patient, woman, brief history, no taint.

1 patient, man, neurotic condition in family, no gross mental disturbance.

Group VII. Manic Depressive Psychoses: 39 patients; 21 women, 18 men.

16 patients, 4 women, 12 men, brief histories, no taint.

3 patients, women, considerable data, no taint.

2 patients, women, tuberculosis in family connections.

3 patients, 1 woman, 2 men, neurotic condition in family.

2 patients, 1 woman, 1 man, epilepsy in family connections.

13 patients, 10 women, 3 men, insanity in family.

Group VIII. Intoxication Psychosis, Alcoholism: 8 patients; 1 woman, 7 men.

6 patients, men, brief histories, only minor taint found.

1 patient, woman, alcoholic ancestry.

1 patient, man, syphilis and insanity in fraternity.

Group IX. Epileptic Psychosis: 6 patients; 3 women, 3 men.

1 patient, man, brief history, no taint.

1 patient, man, neurotic condition, tuberculosis, alcoholism and low mentality among family connections.

4 patients, 3 women, 1 man, insanity and alcoholism among family connections.

Group X. Other Psychoses: 3 patients; men.

Arteriosclerotic Psychosis: 1 patient; man, neurotic condition in fraternity.

Psychopathic Personality—Hysterical Psychosis:

1 patient; man, alcoholism and neurotic condition in ancestry.

Syphilitic Psychosis—Tabo-Paresis:

1 patient; man, insanity, syphilis, neurotic condition, immorality and tuberculosis among family connections.

Summing up these results, it was found that of the 156 patients whose histories were investigated, 61 afforded insufficient data for the determining of heredity; of the remaining 95, regarding whom considerable information was obtained, insanity was present in the ancestry or fraternity of 55, or about 57 percent, and gave mental and physical taint in the connections of practically all the others.

In the course of the regular work of the year certain studies deserve special mention:

Three instances, where both mother and daughter were committed to the institution, were investigated. In two of these cases the mother became insane first; in the other one the daughter's psychosis preceded that of the mother and apparently had a great deal to do with the mother's mental breakdown. In all of these patients there seemed little reason to doubt that the mental disorder of the one of them has been partly contributory to that of the other or, in other words, that the environmental influence of living in the same house with a mentally deranged person has had its effect upon the nervous system of the other person. Whether this effect was more pronounced by reason of the parental or filial relationship than it would have been in the case of a fraternal or collateral relationship, or whether or not the influence was in any way linked with sex, are two interesting problems which it would be impossible to draw any conclusions upon with such limited data. In every one of the three cases mentioned heredity no doubt plays a very large part, and this fact opens up the question as to whether each one of the six

patients mentioned, if removed from the influence to which she was subjected, would not in any case have developed the same psychosis by very reason of her hereditary tendencies. It is, nevertheless, interesting to note that the taint so often shows itself in both mother and daughter.

One father and daughter have been admitted, the father suffering from manic depressive psychosis and the daughter from dementia precox; two men have been admitted with dementia precox whose mothers were formerly here suffering from manic depressive psychosis—additional evidence of the old theory that "Manics breed precoxes." Two of the men admitted afflicted with dementia precox, each of whom had a brother already here suffering from the same psychosis, illustrate the well-known tendency for members of the same fraternity to develop like mental disorders.

One rather interesting history of twin births was noted incidentally. Two sisters, themselves single births but with one instance of twins in their fraternity and one instance in their father's fraternity, married and each had several children, including twins. In each case one of the twins was a daughter who survived, married and herself bore twins. In all there were seven recorded instances of twin births, one in the first generation, one in the second, two in the third and three in the fourth; twice the twins were of the same sex, three times of different sex and twice the sex was unascertainable.

Evidence of the growth of popular interest in eugenics and practical psychology occasionally reach the hospital. A father, relative of a patient, writes for information regarding the hereditary findings in the family in order that he may know how best to guard his children to insure normal mental development. A woman considering the adoption of the little daughter of a patient brings the child to the hospital to have mental tests applied. Now and then advice is asked regarding prospective matrimonial ventures. In view of the recent origin of the science of eugenics and the fact that human heredity is far too complex a problem to be solved hastily, the advice in all cases erred on the side of conservatism rather than toward radical measures.

THE DENTAL DEPARTMENT.

Dr. Annie F. Colley continues as resident dentist. The dental work has progressed satisfactorily during the past year. Owing to the fact that the patients who require dental treatment also suffer from mental trouble, it requires considerable tact to give them necessary attention, and more time is required for each treatment than in ordinary dental practice. A partial list of the operative and prosthetic work is given below:

	Men	Women	Total
Fillings inserted.....	51	155	206
Extractions.....	320	115	435
Gold crowns.....	2	3	5
Porcelain crowns.....	3	1	4
Bridges, new.....	2	1	3
Artificial dentures.....	5	3	8
Artificial dentures repaired.....	3	14	17
Scaling teeth.....	232	27	259

Treatments have been given for pericementitis, abscess, pyorrhea alveolaris, nerve devitalization, putrescent pulp and sensitive dentine.

DEPORTATION OF PATIENTS.

The European war still prevents the deportation of patients whose legal residence has been established in foreign countries. There are now at the institution twenty-six patients under government arrest, and who have been supported by the State of New Jersey for a considerable time although they have no legal residence in the United States.

One female patient, whose residence was in Ireland, and one female whose residence was in Sweden, were deported during the year. The United States Government waived the warrant of arrest on a number of patients who were in fair mental condition, the patients are being cared for at home by their relatives, and

INTERSTATE TRANSFERS.

As soon as a patient enters the institution, careful inquiry is made as to the legal residence. The patient is interviewed, as are the relatives, and the people with whom he may have been resid-

ing. If he is believed to have a residence outside of the State the circumstances are reported to the Commissioner of Charities and Corrections and if he finds the legal residence to be in another state, arrangements are made with the latter State for the return of the patient to his lawful residence. Fourteen patients have been returned to their homes in other states by this arrangement during the past year and this State relieved of the burden of caring for them.

DIVERSIONAL OCCUPATION.

One of the most momentous problems which we have to deal with in this institution is the finding of wholesome employment for that large percentage of patients who will probably spend their years as dependents upon the charity of the State. The utilization of their residual energies and skill is of importance because it not only makes them happier and more contented beings, but also lessens the expense of their maintenance. The incentive of accomplishment is one of the strongest motives in arousing patients to show an interest in any line of work, art or science. Commendation of their work also enhances the interest that patients may show in any particular pursuit.

Since the opening of the Industrial Building two years ago, very satisfactory results have been obtained in the application of the fundamental principles of diversional occupation as a means of treating patients afflicted with mental and nervous diseases. Great care and discretion have been used in selecting apparatus for the proper equipment of this building, and an equal amount of judgment is required in selecting and encouraging patients to engage in the various occupations.

In the printing department and bookbindery the results have been constantly positive, and the development of this industry has been very progressive, both from a medical and an economical standpoint. Patients who have been in this institution for a long time without having contributed anything toward their maintenance have been able to do an order of work in the printing department which, if justly evaluated, would be greatly in excess of actual cost of their maintenance. Several of these

patients are afflicted with mental diseases which are probably incurable; nevertheless, their mental disabilities have not prevented them from becoming diligent workers and productive laborers. The organization of the print shop and bookbindery has been successful primarily because of the constant and regular demand for this kind of work to fulfill the needs of the medical and business departments of this institution.

In the printing department and bookbindery the finished product has been immediately distributed to the various departments of the hospital for use and service. So long as the patients who engage in these occupations feel that the efforts of their labor are productive of utilities which are appreciated by the authorities of the hospital, they seem to be very contented in their work and to keep up constant interest in the accomplishment of the various jobs which are assigned to them, and while they are kept constantly busy their minds do not seem to revert to retrospection or introspection.

In all other branches of diversional occupation there have been at times evidences of lagging interest, due to the fact that the articles which the patients finish are not disposed of, but are set aside for future use or sale. The proposition of establishing an independent working fund to be known as the Diversional Occupation Fund should receive careful consideration. If those who are interested in the success of this practical method of treating patients afflicted with mental and nervous diseases desire to see every phase of these diversional occupations developed to their fullest extent on a highly therapeutic and economic basis, a regular outlet for the product must be afforded.

In fostering the interest of the patients in diversional occupation it has been observed that the equipment, apparatus and the order of handling the work must be similar to that of regular commercial organizations.

In order to bring the patient in closer touch with his friends and relatives the publication of a monthly magazine was started July 1st. The title PSYCHOGRAM, which was given to the magazine, has a significant connotation, and is intended to convey to the general public in a very modest way the unusual capabilities

of people who are unfortunately afflicted with mental disorders. The object of THE PSYCHOGRAM is set forth in its editorial column as follows: "THE PSYCHOGRAM is published chiefly for the purpose of arousing a spirit of congeniality among all those who are residents of this institution; to encourage intellectual and moral improvements in the personalities of all those who have occasion to read it; to bring cheer and gladness to patients who are separated from their friends and relatives; and for the purpose of giving reliable information to friends, relatives and such members of the general public as may be interested in the conduct and welfare of this large public charity maintained at Morris Plains for the treatment and care of persons suffering from the various forms of mental derangement."

The initial and subsequent issues of THE PSYCHOGRAM received very favorable comment from the lay and medical press. This publication has been entered as second-class mail matter at the Greystone Park Post Office. The National Committee for Mental Hygiene, of New York City, has been a regular contributor, sending articles relating to the "Friends of the Insane." The quality of the typographic work which has been done on THE PSYCHOGRAM has been a source of surprise to several expert authorities on printing, and very favorable comment has been received from them in regard to the high quality of the work accomplished. The extra demands made upon the patients for the production of this publication have not only awakened new interest in patients possessing literary ability, but have also helped a great deal to bring out a few more patients who have had experience as printers before they came to the institution, or who showed ability in this art and desired to share somewhat in the glory of this modest publication.

During the year a cement block machine was put into operation and very practical results have been obtained. The patients who are able to engage in this industry may be easily educated or trained to do the various phases of the work and to produce a finished commodity that has a market value greatly in excess of the intrinsic cost of the material. The labor increment is the biggest item in the production of cement articles and can be very easily supplied from two classes of patients—those whose mental

condition is such that they can follow a definite course of instruction, and the others whose minds are so demented that they can only be trained in automatic activities. The patient with the higher order of mentality bosses the job and carries along with him as his assistant the patient with the lower grade of mentality. This method of grouping patients in industries and giving certain ones supervising duties, can be developed very extensively in cement construction. This work also seems to appeal to a certain class of patients who like to indulge in a messy sort of activity. Patients who are destructive or uncleanly in their personal habits will take unusual interest in this kind of work, and when permitted to devote their time to it become steady workers. In the near future a separate building properly and fully equipped with apparatus for doing all kinds of cement work should be established at this institution. With the cement blocks that have already been made the patients will be able to construct such a building with very little expense.

On the upper floor of the Industrial Building the women patients have been given an exceptional opportunity to employ their time in the various arts and crafts. In arranging the equipment, apparatus and decorations of this floor special effort was made to give the place a homelike appearance, so that the women could enjoy the same atmosphere as if they were attending a sewing circle. In order to arouse the interest of the patients in the work, they are permitted to occupy at least one-half their time in working upon articles for their own personal use. If a patient has been fortunate enough to receive from home a piece of cloth or other fabric sufficient to make a dress, she is permitted to draft her own pattern and do all the sewing required in making it. The women patients have been very delighted with this treatment; more ambition has been aroused among them in the work which is being done in the Industrial Building, and already we find that the floor space which we have in this building and the extension will in a short time be inadequate to meet the demands placed upon us by patients desiring to devote their time to the various arts and crafts work.

PATIENTS' COMPOSING ROOM AT PRINT SHOP

In the print shop 375 jobs have been done, aggregating 550,000 impressions; 1,800 annual reports of 100 pages each have been completed. Four issues of THE PSYCHOGRAM have been completed. Fifty different kinds of ruling jobs have been accomplished.

There were two groups of patients working this year at competitive gardening. One group was in charge of a competent attendant who understands gardening thoroughly. The other group was in charge of a patient who has acquired sufficient knowledge since he has been here to take charge of the garden and a few fellow patients. Both gardens were very successfully operated, and the patients were rewarded by an abundance of produce as a result of their labor. The cultivation of the willow-holt was carried on by the patients who worked in the garden and those who were engaged in the various indoor occupations of the Industrial Department. When the weather was pleasant in the spring and summer, the patients who were working indoors were given an opportunity to work in the open air on the willow-holt. The crop of willows has been very abundant this year, and the total product will be at least five times greater than the first year's crop.

The following is an itemized account of the work that has been done in the industrial divisions, including the amount of produce obtained from the patients' gardens:

PRODUCE FROM THE PATIENTS' GARDEN.

Beans, Golden Wax..	bushels	20
“ Pole Lima....	“	13½
“ String.....	“	26
Beets.....	“	46
Cabbage, Early.....	heads	900
“ Late.....	“	300
Carrots.....	bushels	69
Cauliflower.....	heads	73
Celery.....	stalks	1,170
Corn.....	“	75
Cucumbers.....		1,050
Egg Plants.....		474
Lettuce.....	bunches	695

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Onions.....	bunches.....	2,385
"	bushels	6
Peas	"	24½
Peppers.....		1,220
Pumpkins.....		135
Radishes	bunches	2,845
Spinach	bushels	18
Strawberries.....	quarts	3,234
Sweet Corn.....	ears	5,455
Tomatoes.....	bushels	186½
Turnips	"	27

The average attendance of patients was 21 a day, and there were 312 workdays.

WORK DONE IN THE ARTS AND CRAFTS ROOM BY
WOMEN PATIENTS.

Aprons.....	1
Crochet Belts.....	4
Crochet Hand Bags.....	1
Crochet Piece for Tray, 18x27	1
Crochet Slippers, pair.....	2
Crochet Ties, pair.....	2
Crochet Wash Cloths	6
Drawn Work Runners	1
Embroidery Runners.....	2
Guest Towels.....	1
Lace Center Pieces.....	1
Lace Collars.....	2
Lace Edging, yards.....	14
Lace Ruching, yards.....	2½
Pillow Cases, pair	2
Raffia Baskets	7
Raffia Hand Bags.....	2
Reed Baskets.....	1
Table Mats.....	6
Tatted Medallions	58
Toweling Hand Bags.....	6
Towels, Hemmed, dozen.....	37

WORK DONE IN THE BOOKBINDERY.

Annual Reports bound.....	50
---------------------------	----

Booklets bound, Blank	5
Books bound and repaired	23
Books repaired for Patients' Library	102
Hymnals bound and repaired	50
Large Ledger Books for Supervisors' Offices	12
Photo Books bound, new	2
Prayer Books	1
Scrap Books	1
Time Books	12
Writing Pads	24

WORK DONE IN THE INDUSTRIAL ROOMS AT THE DORMITORY BUILDING.

Apron Strings, yards	548
Arm Chairs caned	14
Baby Clothes Racks	6
Benches for Hook Rugs	6
Brooms	60
Cartoons	19
Cement Building Blocks, 8x8x16	1,361
Cocoa Fibre Mats	18
Concrete Boxes	1
Draught Screens	4
Fish Nets	55
Flower Baskets	10
Hall Tree	1
Large Work Table	1
Large Settees caned	6
Laundry Bags mended	13 doz.
Laundry Baskets repaired	167
Market Baskets	12
Mission Couch	1
Neck Bands for Aprons, yards	20
Office Chairs caned	4
Pedestals	1
Pen and Ink Sketches	9
Pictures Framed	58
Rag Carpet Rugs	19
Reed Baskets	20
Rocking Chairs caned	22
Scrub Brushes	501
Shipping Cases of Old Lumber	1
Tables	1

Towels.....	159
Umbrella Stand.....	1
Ward Chairs caned.....	360
Water Color Sketches.....	2
Hook Rugs.....	6

PATIENTS' WORK.

In addition to the diversional occupation regularly organized a large number of patients were employed in numerous other lines of work. The construction of the Mortuary Building, grading of patients' amusement grounds and erection of foundations for various new structures required the services of many of the men patients.

As usual, a record has been kept of the number of days' work done by the men and women patients, as is indicated by the following tables. These occupations have proven beneficial to the mental and physical health of the patients who could be encouraged to participate.

PATIENTS' WORK.

TABLE A

NUMBER OF DAYS' WORK DONE BY PATIENTS IN THE INDUSTRIAL DEPARTMENTS

	LAUNDRY		Kitchen	Farm, Grounds & Gardens	Bakery	Shops	Sewing	Miscellaneous Work	Patients' Industrial Department	Arts & Crafts	Total
	Men	Women									
1915											
November	550	976	528	890	90	623	670	1,979	2,415	130	8,851
December	604	1,112	550	1,577	94	341	675	1,817	2,362	85	9,217
1916											
January	600	1,080	441	1,564	96	337	616	1,871	2,415	87	9,107
February	573	1,063	414	1,568	90	329	573	1,712	2,387	100	8,809
March	602	1,127	458	1,831	95	401	618	1,878	2,555	138	9,703
April	659	996	471	1,733	98	379	609	1,721	2,412	110	9,188
May	663	1,113	521	2,051	94	360	648	1,764	2,520	...	9,734
June	650	1,170	466	2,122	93	363	598	1,769	2,520	600	10,351
July	657	1,244	458	1,986	98	351	606	1,897	2,362	900	10,559
August	646	1,256	458	1,990	106	383	684	1,833	2,625	1,000	10,981
September	696	1,092	593	1,782	103	359	624	1,742	2,362	1,237	10,590
October	707	1,113	535	1,673	104	357	593	1,762	2,520	1,440	10,804
Total	7,607	13,342	5,893	20,767	1,161	4,583	7,514	21,745	29,455	5,827	117,894

TABLE

NUMBER OF DAYS' WORK DONE BY PATIENTS ON THE WARDS

1915	<i>Men</i>	<i>Women</i>	<i>Total</i>
November.....	9,120	6,526	15,646
December.....	9,548	6,500	16,048
1916			
January.....	9,548	6,369	15,917
February.....	8,370	6,200	14,570
March.....	8,820	6,488	15,308
April.....	8,768	6,440	15,208
May.....	9,272	6,023	15,295
June.....	8,900	6,530	15,430
July.....	9,270	6,509	15,779
August.....	9,160	6,504	15,664
September.....	8,580	6,508	15,088
October.....	8,866	6,836	15,702
Total.....	108,222	77,433	185,655

AMUSEMENTS.

During the past year the patients have been given such amusements as the hospital means would permit. Moving picture shows have been given regularly every two weeks and are as popular as ever, both with the patients and employees. These picture shows not only amuse the patients and divert their minds from their mental troubles, but are also very much appreciated by the help at the hospital. On each evening when moving pictures are shown, a dance is held in conjunction with the cinema.

Dancing is one of the popular diversions, and the patients have had ample opportunity to indulge in the terpsichorean art during the past year. Dances in the open air pavilion were inaugurated the past spring, and on Wednesday and Friday afternoons the patients enjoy these outdoor dances. The usual Monday evening dance is a fixed social affair and is called by the patients "The Weekly Ball."

Athletics have received considerable attention. The women patients take great pleasure in playing croquet. The men patients still have a predilection for baseball. The Greystone Park Field Club, which is the name of the regular baseball team at the insti-

STATE HOSPITAL FIELD DAY, SEPTEMBER 7, 1916
OBSTACLE RACE

tution, played twenty games this year and won eighteen. The games are very well attended by the patients who derive a great deal of enjoyment out of them.

The usual vaudeville shows were given on Thanksgiving, Christmas and Washington's Birthday. Some of the women patients took advantage of Hallowe'en to hold a Hallowe'en party and furnished light refreshments for their enjoyment.

The numerous snow storms during the winter enabled us to give all the patients in fair mental and physical condition a number of sleigh rides.

Field Day was celebrated September 7th, 1916, and the events of the occasion follow :

- 1st heat, 100 yd. dash for patients
- 2nd heat, 100 yd. dash for patients
- 1st heat 100 yd. dash for employees
- 2nd heat 100 yd. dash for employees
- 3rd heat 100 yd. dash for employees
- Final, 100 yd. dash for patients
- Wheelbarrow race for patients
- 50 yd. dash for women patients
- Final, 100 yd. dash for employees
- 1-4 mile run for patients
- 100 yd. dash for women nurses
- Two sack races for patients
- 220 yd. dash for employees
- 220 yd. dash for patients
- 1-2 mile race for employees
- 1st heat, 120 yd. hurdle
- 2nd heat, 120 yd. hurdle
- 3rd heat, 120 yd. hurdle
- Obstacle race for employees
- Final, 120 yd. hurdle
- 16-lb. shot put for employees
- Potato race for women
- 1-2 mile race for patients
- High jump
- Special event
- 100 yd. dash for women patients
- Pole vault
- 220 yd. dash for women nurses
- Relay races (patients of Dormitory Bldg. vs. patients of Main Bldg.)

1-mile bicycle race

Relay race for employees of Dormitory Bldg. vs. employees of Main Bldg.

2-mile bicycle race

Tug of war between Dormitory Bldg. and Main Bldg.

Judges—Board of Managers, Dr. B. D. Evans and Staff

Master of Ceremonies and Starter—Dr. G. B. McMurray

MUSICAL PROGRAMME.

March { "Star-Spangled Banner."
"Entry of the Gladiators."

Medley Selection—"The King Pin."

Fox Trot—"In Old Brazil."

March—"National Defense."

Cornet Solo—"Sunshine of Your Smile."

March—"Are You From Dixie?"

Selection—"Faust."

March—"Flag of Victory."

FIREPROOF VAULTS AND FILING CABINETS.

From year to year I have asked for an appropriation in order that the medical records of the hospital might be cared for in a satisfactory manner. Every patient's history, from the first one who entered the institution on August 17, 1876, is filed at the hospital. These records are often called for by the various courts in the State and the hospital authorities would be greatly embarrassed should a fire occur and the records be destroyed. They are of such a character that they cannot be replaced. In most hospitals for the insane a fireproof vault is provided to care for these case records, and this institution should also be equipped with a vault for that purpose.

LODGE HOUSE AND GATE.

The population in the vicinity of the hospital is rapidly increasing. There are many trespassers and curious sightseers about the hospital's grounds every day, and to keep track of them and see that they do not disturb the patients is a serious proposition. I would recommend that a lodge house and gate be provided at

the center drive, where all individuals wishing to enter the hospital grounds could be provided with passes, and in that way give us better control of those who visit the institution. Automobiles, especially on Sundays, use the center drive as a favorite road. Their occupants are rather annoying in the remarks they make about the patients who are out for walks and recreation, and their speeding at times is attended with much danger to patients. Such visitors occasionally hand patients articles to use in endeavoring to escape from the hospital. On several occasions friends of patients have driven on the institution grounds in an auto and kidnapped patients from our custody.

ADDITIONAL QUARTERS FOR ASSISTANT PHYSICIANS.

At the present time there are ten assistant physicians on the hospital staff, which number is not adequate to look after the number of patients in the institution. In most States where careful consideration is given to the ratio of physicians to patients, the law requires the appointment of an additional physician to each increase of 150 patients. Were this State to pass the same law, it would mean the appointment of eight additional assistant physicians. Should the State appropriate the money for the appointment of this number of physicians, we would at present have no place for them to reside. As a matter of fact, the present assistant physicians are crowded together in two apartments and have not the accommodations which very much smaller hospitals than this give their internes. Three members of the present staff have found it necessary to ask permission to live in cottages not on the hospital grounds. They are often needed at night when their services cannot be commanded. This works a detriment to the service. The cottages would remedy this.

A physician in a State hospital is on duty twenty-four hours a day, except for a day or so occasionally, when he is permitted to leave the hospital grounds. When physicians are called upon to render such continuous service, they should be furnished with proper and comfortable living apartments. A number of the

physicians on the staff are married and cannot enjoy anything resembling home life under the present conditions. I believe the State would make no error in building a staff house for the single physicians, where each physician could have at least one room and bath, and erecting bungalows for the married physicians. If the hospital is to retain the services of the physicians who are equipped to do this line of work satisfactorily, it will be necessary to provide better accommodations for them.

ADDITION AND EQUIPMENT FOR NEW PATHOLOGICAL LABORATORY AND MORTUARY BUILDING.

Owing to the fact that the original appropriation for the construction of a pathological building and mortuary had not been released until the very last month of the hospital year, it was found impossible to obtain bids low enough to construct the building according to the original plans and specifications because building material had advanced from fifteen to twenty-five percent during the time which elapsed from the approval of the original appropriation till the release of the same. By special arrangement certain important features were omitted with the hope of obtaining an additional appropriation later to complete this building. The large bulkhead, which was to be located on the roof, is required for the purpose of properly housing the various animals, such as rabbits and guinea-pigs, which are absolutely essential in carrying on the pathological work. A porte-cochere is also needed to complete the basement floor exit and to place the exit in sufficient obscurity so that the transference of the patients' bodies from the building to the undertaker's wagon will not be noticed by people who have occasion to pass in the neighborhood of this building.

Additional equipment will also be required to enable the pathologist to carry on his work in a thorough manner without the handicap of makeshift apparatus or inadequate material for work.

AUTO STAGES FOR PATIENTS.

The hospital should be provided with two auto busses, so that the patients may be taken out for rides at stated intervals.

During the winter months the patients occasionally get out for a sleigh ride. I see no reason why they should not get more opportunity to get away from the hospital grounds and see some of the surrounding country. Auto busses could be used part of the day by the business department in hauling freight. There are some patients who are too feeble to walk a great distance, and for these patients the auto busses would be a great boon. These busses could be used for business and commercial necessities and reduce the cost of numerous forms of transportation and at the same time give a more expeditious and satisfactory service in keeping with other State institutions throughout the country.

VACUUM CLEANERS.

Now that the wards are equipped with electricity, the antiquated method of sweeping with hand-brooms should be supplanted by the use of vacuum cleaners which can be operated by making a connection with the electric socket. By installing vacuum cleaners the sweeping will be expedited and done in a sanitary way, and not only leave considerably more time for the nurses to devote to personal attention to the patients, but minimize the possibility of infection being spread. This item has so much to commend it that elaboration is deemed unnecessary.

CIRCULATING LIBRARIES FOR PATIENTS.

The last session of the Legislature appropriated \$200 for the purchase of books for the patients' library. I was fortunate enough to obtain 184 volumes of high grade reading matter with this fund. These books have been placed in sectional bookcases in one of the reception rooms in the Main Building and a clerk has been made librarian in addition to her other duties. This is the beginning of a circulating library for the patients at this institution, and is greatly appreciated by the more intellectual patients. On rainy days, instead of being compelled to sit about the wards, they now have the opportunity to go to the circulating library and look over the books for an hour or so before they eventually select a book to take with them to the ward. I trust

the Legislature will see its way clear to give this institution appropriations every year until we have a fair-sized library, from which the patients may select such books as they desire to read. It promotes good and orderly conduct, diverts the minds of the diseased, and operates to benefit a large number of our sick.

TRAINING SCHOOL AND COMMENCEMENT.

A Training School for Nurses and Attendants at this institution has been in existence since 1894. During that time 240 nurses have been graduated. The course consists of three years of didactic lectures and practical work on the wards. Nurses are also given instructions in the hydrotherapeutic room, the continuous bath department and in the diversional occupation department in the Industrial Building. The course is optional, and before a nurse is permitted to enter the Training School, a fair knowledge of arithmetic, civil government, geography and the English language must be shown, an examination for that purpose being given before the opening of the Training School.

During the course of 1914-16 five nurses showed sufficient qualifications to be permitted to graduate. They were:

Marie A. Curran,	Mae Evelyn Merkle,
Paula Ruth Gitterman,	Margaret Anne Sweeney,
Herman Kohles.	

The diplomas and class pins were awarded to these nurses at a commencement held in the hospital chapel on the evening of June 14, 1916. Rev. Harold B. Drew, of Morristown, opened the exercises with a prayer. The address of the evening was delivered by Rev. Harry S. Everett, of the Public Forum, of Jersey City. The class pins were presented by Hon. P. J. Ryan, of Elizabeth, N. J., President of the Board of Managers, while the Medical Director conferred the diplomas. During the exercises the hospital orchestra rendered several selections. A dance for the graduates and their guests closed the evening's program.

Chapter 167, Laws of 1916, Approved March 17, 1916, concerning the Government and Management of Hospitals for the Insane, in Section 9, requires that :

PATIENTS ENGAGED IN CHAIR CANING

"A Training School for Nurses shall be maintained, the course to be approved by Commissioner of Charities, and consist of three years, six months of which time (either before or after graduation) shall be spent in training in a general hospital, and such graduates shall be eligible for registration. *Proviso:* Former graduates to be considered properly qualified for registration."

This places the Training School of this hospital in a position to give its graduates an opportunity to become registered nurses in this State, and, I trust, will be the means of our getting a higher grade of help to care for the patients and to keep such help until they have taken the three years' course of training.

The medical staff gives the didactic lectures and the supervisors and graduate nurses the practical instruction. The list of the different subjects on which lectures and instructions are given with the names of the instructors, is given below:

Dr. Britton D. Evans: The Qualifications of a Nurse, and History of Hospital Care of Insane.

Dr. E. Moore Fisher: Mental and Nervous Diseases.

Dr. Louis K. Henschel: Dietetics; Hydrotherapy.

Dr. George A. Anderton: Materia Medica.

Dr. Marcus A. Curry: Medicine.

Dr. George R. Hampton: Surgery.

Dr. George B. McMurray: Genito-Urinary Diseases (men only); Diseases of the Eye.

Dr. Frederic H. Thorne: Pathology and Bacteriology; Chemistry and Physics.

Dr. Frank M. Mikels: Hygiene and Diversional Occupation.

Dr. Julia C. Cotton: Physiology; Gynecology (women only).

Dr. H. Raymond Mutchler: Anatomy.

Miss Mary R. Keegan, Supervisor: Instructor in Ward Work and Discipline.

Miss Phoebe Northwood, Supervisor: Instructor in Bandaging.

Miss Julia B. Maguire, Supervisor: Instructor in Hydrotherapy.

Miss Jennie B. Markey, Supervisor: Instructor in Diet Preparation.

Mr. William Moran, Nurse: Instructor in Feeding and Diet Preparation.

HOURS FOR NURSES.

For years the nurses at this institution have been compelled to work from 6:30 in the morning until 9 at night. On the convalescent wards the work has never been arduous, and the nurses have spent a goodly part of the day in the park with the patients. On the infirmary wards this length of duty, we have recognized for a long time, is too long to enable the nurses to do efficient work. After considerable difficulty I have put every nurse, irrespective of the ward on which she is employed, on a twelve-hour schedule. Under the present arrangement the day nurses report for duty at 6:30 A. M. and are relieved at 6:30 P. M., at which hour the night nurses take charge of the various wards. I trust that this reduction in the working hours will result in our getting a sufficient number of nurses in order to bring our nursing corps up to the regular number.

RELIGIOUS SERVICES.

No change has been made in the order of religious services held in this institution during the past year. The evangelical churches take turns in holding services Sunday afternoons from 3 to 4 o'clock. For the Catholic patients mass is celebrated on Tuesday morning of each week. Communion services are conducted by the Episcopal Church the first Thursday morning of each month. On the second Saturday of each month and on the more important holidays, in the Jewish faith, religious services are held for the Hebrew patients. These services are under the direction of Rev. Dr. Solomon Foster, of Newark, N. J.

Below is a schedule of the Sunday chapel services from November 1, 1915:

November	7	Presbyterian	May	7	Baptist
"	14	Methodist	"	14	Episcopalian
"	21	Baptist	"	21	Presbyterian
"	28	Episcopalian	"	28	Methodist

December	5	Presbyterian	June	4	Baptist
"	12	Methodist	"	11	Episcopalian
"	19	Baptist	"	18	Presbyterian
"	26	Episcopalian	"	25	Methodist
January	2	Presbyterian	July	2	Baptist
"	9	Methodist	"	9	Episcopalian
"	16	Baptist	"	16	Presbyterian
"	23	Episcopalian	"	23	Methodist
"	30	Presbyterian	"	30	Baptist
February	6	Methodist	August	6	Episcopalian
"	13	Baptist	"	13	Presbyterian
"	20	Episcopalian	"	20	Methodist
"	27	Presbyterian	"	27	Baptist
March	5	Methodist	September	3	Episcopalian
"	12	Baptist	"	10	Presbyterian
"	19	Episcopalian	"	17	Methodist
"	26	Presbyterian	"	24	Baptist
April	2	Methodist	October	1	Episcopalian
"	9	Baptist	"	8	Presbyterian
"	16	Episcopalian	"	15	Methodist
"	23	Presbyterian	"	22	Baptist
"	30	Methodist	"	29	Episcopalian

These services were in charge of the following clergymen:

Rev. Dr. Thomas T. Crawford, Methodist, Morristown.

Rev. Harold B. Drew, Baptist, Morristown.

Rev. M. J. Glennon, Roman Catholic, Morris Plains.

Rev. W. W. Hammond, Presbyterian, Morris Plains.

Rev. Barrett P. Tyler, Episcopal, Morristown.

DONATIONS TO THE CHRISTMAS FUND.

Christmas of 1915 was one that will long be remembered by the patients at this institution. Kind friends of the hospital were so generous in their contributions that a present was given to each of the 2,700 patients.

I wish to make grateful acknowledgment to the following for their generous contributions to the Christmas Fund, and to assure them that they have aided in making the lives of the patients more happy for quite a time:

NEW JERSEY STATE HOSPITAL.

Mr. W. A. Abbott, Flemington.
Mrs. Emma Louise D. Alling, Newark.
Mrs. Armstrong, Rutherford.
The Bible Class, First Presbyterian Church, Paterson.
Mrs. Pauline Bodine, Plainfield.
Dr. G. A. Becker, Morristown.
Mrs. Carolyn Blakeslee, Jersey City.
Miss Carrie Budd, Chatham.
Mrs. A. Burnett, Ridgewood.
Mr. and Miss Cook, Elizabeth.
Mr. Frank K. Chew, Newark.
Miss Nellie J. Fosdick, Tenafly.
Mrs. L. H. Vreeland, Orange.
Mrs. C. F. French, Plainfield.
Miss Elizabeth Grover, Newark.
Mrs. George W. Heimel, Englewood.
Mrs. E. Highan, Paterson.
Mrs. C. E. Hooper, Rutherford.
Mr. Mahlon L. Hoagland, Rockaway.
Mr. T. Howard, East Orange.
Mr. S. F. Jensen, Elizabeth.
Miss F. Kauffinger, Jersey City.
Mrs. Keep, Jersey City.
Mrs. Daniel J. King, Jersey City.
Mrs. A. E. Kirkner, Plainfield.
Mr. F. W. Krayner, Paterson.
Mr. Albert Lewis, Phillipsburg.
Mrs. Maken, Dover.
Mrs. H. V. Meeks, North Bergen.
Mrs. Harry C. Miller, Paterson.
Miss Rose Minnich, Paterson.
Mme. Marie Pierson, East Orange.
Miss Estelle E. Potter, Elizabeth.
Miss M. Protz, Elizabeth.
Mr. James Radcliff, Paterson.
Mrs. C. Remstew, Newark.
Mr. John Rysak, Passaic.
Mrs. B. Schaub, Newark.
Mr. Emil Schildt, Irvington.
Mrs. A. Shea, Jersey City.
Mrs. F. E. Sherwood, Newark.
Mrs. W. J. Stanton, Newark.
Mrs. E. Steadman.
Miss Annie C. Steadman, Wellesley, Mass.

Miss Florence Stewart, New York City.
 Mrs. W. H. Stoeber, East Rutherford.
 Mrs. J. S. Stone, Stewartville.
 Mr. Alessandro Tremitedi, New York City.
 Mrs. Sarah Tunies, Dover.
 Miss A. L. Vail, Plainfield.
 Mr. John Walker, New York City.
 Mr. Edward T. Ward, Newark.
 Mr. Arthur Whitney, Gladstone.
 Mrs. Henry A. Young, New York City.
 Mrs. Mary Lyon, Jersey City.
 Mr. James R. Voorhees, Morristown.
 Mr. George H. Howell, Weehawken.
 Mr. Walter Meyer, East Orange.

NEWSPAPERS.

I wish to take this opportunity to thank the editors and proprietors of the various newspapers for their kindness in keeping this institution supplied with papers. As they come from their homes, the patients read them with great pleasure and interest. A list of the papers regularly served to the hospital is published here:

The Better Citizen, Rahway.	Hunterdon County Democrat, Flemington.
Bloomfield Citizen.	
Boonton Times.	Hunterdon County Republican, Flemington.
Boonton Weekly Bulletin.	
Butler Argus.	The Jerseyman, Morristown.
Camden Post-Telegraph.	Madison Eagle.
Carlstadt Freie Press.	Milford Leader.
The Christian Work, New York City.	The Morning Call, Paterson.
Clinton Democrat.	Morris County Chronicle, Morristown.
Daily State Gazette, Trenton.	Newark Sunday Call.
De Telegraph, Paterson.	Paterson Evening News.
Dover Advance.	Paterson Guardian.
Elizabeth Daily Journal.	Paterson Press.
Hackensack Republican.	Passaic Daily Herald.
Standard and Times, Philadelphia.	Passaic Daily News.
Somerset Democrat.	Rockaway Record.
Summit Record.	The Standard, Westfield.
Sussex Independent.	Summit Herald.

Trenton Evening News.

Wantage Recorder, Deckertown.

Washington Star.

Sunday Chronicle, Paterson.

Town Talk, Newark.

True Democratic Banner, Morristown.

Warren Tidings, Washington.

MEDICAL STAFF RESIGNATIONS AND APPOINTMENTS.

Dr. H. Raymond Mutchler resigned on May 1st, to enter into private practice in Dover, N. J. Dr. Julia C. Cotton also resigned on May 1st. Dr. Frederic H. Thorne, who has been resident pathologist in the institution for five years, resigned on July 1st. Dr. Thorne obtained a commission as First Lieutenant in the First New Jersey Field Hospital Corps. Dr. Frank M. Mikels was appointed to the position of pathologist.

A competitive examination was held to fill the three vacancies caused by these resignations. Dr. Paul A. Petree was appointed to the position formerly held by Dr. Mikels and was to report on July 1, 1916. Before that time, however, he received an appointment in the American Red Cross, at Paris, France, and took that position. Dr. H. A. Wallhauser was appointed junior assistant physician and reported for duty on May 29th. Dr. Elain F. Srygley was appointed junior assistant physician and reported for duty on June 1st, 1916.

Dr. Frank S. Gray, one of the consulting surgeons of this hospital, died during the past year. He was always ready to answer any calls that were made upon him by the medical staff of this hospital, and performed a number of operations at this institution. His kind advice and suggestions will be greatly missed. Dr. Gray was an eminent surgeon, interested in the betterment of mankind, and was ex-president of the New Jersey State Medical Society.

CONCLUSION.

The overcrowded condition of this institution has as yet been but little relieved. In addition to the mental strain caused by the fact that we are looking after about one thousand more patients than there is room for, has been added that caused by the

scarcity of nurses and attendants. For more than a year it has been impossible to get sufficient help, and most of the year we were looking after the patients with practically only one-half the regular nursing corps. The numerous changes on the medical staff have also retarded the work.

I wish to express my thanks to my assistants and to those who have rendered efficient service during the year. My gratitude is expressed to the members of the Board of Managers for their advice and aid during the year in my endeavor to run this hospital in the high grade of efficiency which has always been set for it.

Very respectfully submitted,

BRITTON D. EVANS,

Medical Director.

October 31st, 1916.

STATISTICAL APPENDIX TO MEDICAL DIRECTOR'S REPORT.

Statistical Appendix to the Medical Director's Report

TABLE I.

SHOWING THE ADMISSIONS, DISCHARGES AND DEATHS DURING THE YEAR ENDING
OCTOBER 31, 1916.

In the hospital October 31st, 1915	<i>Men</i> 1,335	<i>Women</i> 1,334	<i>Total</i> 2,669
Patients admitted—	<i>Men</i>	<i>Women</i>	<i>Total</i>
First admissions.....	277	253	530
Re-admissions.....	23	43	66
Total	300	296	596
Total under treatment during the year.....	1,635	1,630	3,265
Patients discharged—	<i>Men</i>	<i>Women</i>	<i>Total</i>
Recovered.....	46	48	94
Improved.....	95	80	175
Unimproved.....	30	38	*68
Died.....	132	108	240
Total	303	274	577
Remaining in hospital—	<i>Men</i>	<i>Women</i>	<i>Total</i>
Public.....	1,232	1,198	2,430
Private.....	100	158	258
Total.....	1,332	1,356	2,688
Whole number admitted from August 17th, 1876, to October 31st, 1916	6,904	6,489	13,393
Whole number discharged during the same period of time—	<i>Men</i>	<i>Women</i>	<i>Total</i>
Recovered.....	1,499	1,504	3,003
Improved.....	1,167	1,322	2,489
Unimproved.....	419	397	816
Died.....	2,454	1,909	4,363
Escaped.....	31	....	31
Not insane.....	2	1	3
Total.....	5,572	5,133	10,705
Remaining October 31st, 1916.....	1,332	1,356	**2,688

*Twenty-four men and twenty-eight women transferred to the New Jersey State Village for Epileptics at Skillman.

**Twelve men carried as escaped; one woman carried on visit.

TABLE II.

MONTHLY ADMISSIONS, DISCHARGES AND AVERAGES.

	ADMISSIONS			DISCHARGES AND DEATHS			DAILY AVERAGES		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
1915									
November.....	28	25	53	14	20	34	1323.47	1329.07	2652.54
December.....	19	23	42	22	16	38	1327.92	1337.94	2665.86
1916									
January.....	34	30	64	32	27	59	1332.61	1342.35	2674.96
February.....	25	30	55	17	27	44	1338.04	1347.31	2685.35
March.....	35	24	59	22	25	47	1347.54	1347.46	2695.00
April.....	27	24	51	22	12	34	1352.26	1352.51	2704.77
May.....	22	23	45	24	23	47	1352.17	1355.92	2708.09
June.....	20	25	45	30	31	61	1338.70	1350.90	2689.60
July.....	23	31	54	17	21	38	1336.03	1354.53	2690.56
August.....	21	25	46	30	21	51	1331.65	1362.78	2694.43
September.....	24	18	42	17	25	42	1330.62	1361.29	2691.91
October.....	22	18	40	56	26	82	1327.63	1353.95	2681.58
Total.....	300	296	596	303	274	577			

TABLE III.

NUMBER OF ATTACKS OF THOSE ADMITTED.

<i>Attacks.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
First.....	146	137	283
Second.....	23	35	58
Third.....	7	15	22
Fourth.....	1	3	4
Fifth and over.....	4	6	10
Unascertainable.....	119	100	219
Total.....	300	296	596

TABLE IV.

AGE WHEN FIRST ATTACKED OF THOSE ADMITTED.

<i>Age.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Under fifteen years.....	3	4	7
Fifteen to twenty years.....	13	15	28
Twenty to twenty-five years.....	11	27	38
Twenty-five to thirty years.....	23	19	42
Thirty to thirty-five years.....	17	18	35
Thirty-five to forty years.....	20	20	40
Forty to forty-five years.....	20	19	39
Forty-five to fifty years.....	10	13	23
Fifty to sixty years.....	14	16	30
Sixty to seventy years.....	11	10	21
Seventy to eighty years.....	8	3	11
Eighty and over.....	2	3	5
Unascertainable.....	148	129	277
Total.....	300	296	596

TABLE V.

NATIVITY OF THOSE ADMITTED.

<i>Nativity.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Arizona .....	..	1	1
California.....	1	..	1
Connecticut.....	2	1	3
Georgia	1	..	1
Illinois .....	..	1	1
Indiana.....	..	1	1
Kansas .....	..	1	1
Kentucky.....	..	1	1
Maryland.....	2	2	4
Massachusetts.....	2	3	5
Michigan	2	1	3
Minnesota .....	..	2	2
NEW JERSEY.....	99	82	181
New York.....	33	44	77
North Carolina.....	..	1	1
Ohio.....	3	5	8
Pennsylvania	10	6	16
South Carolina.....	1	2	3
Tennessee .....	..	1	1
Texas	1	..	1
Vermont.....	1	1	2
Virginia	2	6	8
Wisconsin .....	..	1	1
United States.....	4	4	8
<hr/>			
Total native born.....	164	167	331
Austria-Hungary	28	21	49
Bohemia.....	1	..	1
Bulgaria	1	..	1
Burmah.....	1	..	1
Canada.....	1	..	1
China	1	..	1
Denmark .....	..	1	1
England	8	3	11
Finland.....	1	1	2
France	1	2	3
Galicia.....	..	2	2
Germany	19	22	41
Holland	3	5	8

			<i>Men</i>	<i>Women</i>	<i>Total</i>
Ireland	7	24	31		
Italy	28	22	50		
Norway .....	..	1	1		
Poland	3	4	7		
Rumania	1	1	2		
Russia	18	13	31		
Scotland....	2	2	4		
Sweden.....	3	2	5		
Switzerland	2	3	5		
Wales.....	1	..	1		
West Indies	1	..	1		
Total foreign born.....			131	129	260
Unascertainable			5	..	5
Total.....			300	296	596

TABLE VI.

RESIDENCE OF THOSE ADMITTED.

<i>County.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Bergen	50	44	94
Camden	1	..	1
Cape May.....	..	1	1
Essex.....	47	52	99
Hudson.....	53	55	10
Hunterdon.....	1	1	2
Middlesex	4	1	5
Morris.....	33	23	56
Passaic	44	57	101
Somerset	3	..	3
Sussex.....	9	7	16
Union.....	53	54	107
New York.....	2	1	3
Total.....	300	296	596

TABLE VII.

CIVIL CONDITION OF THOSE ADMITTED.

<i>Civil Condition.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Single.....	121	92	213
Married.....	149	154	303
Widowed.....	17	47	64
Divorced.....	3	..	3
Unascertainable.....	10	3	13
Total.....	300	296	596

TABLE VIII.

OCCUPATION OF THOSE ADMITTED.

<i>Occupation.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Agents.....	1	..	1
Artists.....	2	..	2
Bakers.....	1	..	1
Barbers.....	3	..	3
Bartenders.....	1	..	1
Basketmakers.....	2	..	2
Blacksmiths.....	1	..	1
Boilermakers.....	3	..	3
Bookkeepers.....	2	3	5
Brokers.....	3	..	3
Butchers.....	3	..	3
Cabinetmakers.....	1	..	1
Carpenters.....	9	..	9
Chauffeurs.....	1	..	1
Chemists.....	1	..	1
Cigarmakers.....	1	..	1
Clergymen.....	2	..	2
Clerks.....	21	2	23
Combmakers.....	1	..	1
Confectioners.....	1	..	1
Constables.....	1	..	1
Contractors.....	1	..	1
Cooks.....	1	2	3
Dairymen.....	1	..	1
Dentists.....	1	..	1
Designers.....	1	..	1
Domestics.....	..	22	22
Dressmakers.....	..	2	2

<i>Occupation.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Drivers	2	..	2
Dropforgers.....	1	..	1
Druggists.....	1	..	1
Electricians.....	2	..	2
Embroiderers .....	..	1	1
Engineers.....	3	..	3
Engravers.....	1	..	1
Factory hands.....	2	5	7
Farmers.....	12	..	12
Firemen.....	1	..	1
Florists.....	1	..	1
Furniture polishers.....	1	..	1
Gardeners.....	4	..	4
Hostlers.....	2	..	2
Housekeepers.....	..	5	5
Housewives.....	..	106	106
Housework.....	..	97	97
Inspectors.....	1	..	1
Ironworkers.....	1	..	1
Laborers.....	69	..	69
Lawyers.....	2	..	2
Longshoremen.....	2	..	2
Machinists.....	7	..	7
Managers.....	3	..	3
Marble polishers.....	1	..	1
Mariners.....	1	..	1
Masons.....	1	..	1
Merchants.....	12	..	12
Metalworkers.....	1	..	1
Millhands.....	3	2	5
Milliners.....	..	1	1
Miners.....	3	..	3
Needle swagers.....	1	..	1
Nurses.....	..	5	5
Painters.....	6	..	6
Patternmakers.....	1	..	1
Peddlers.....	1	..	1
Pipefitters.....	2	..	2
Plumbers.....	5	..	5
Policemen.....	2	..	2
Postmasters.....	1	..	1
Powderworkers.....	2	..	2
Printers.....	2	..	2
Rubber workers.....	2	..	2

<i>Occupation.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Salesmen	3	..	3
Saloonkeepers	3	..	3
Seamstresses .....	..	3	3
Shoemakers	1	..	1
Silkworkers	6	..	6
Silversmiths	1	..	1
Stenographers	1	2	3
Students	5	4	9
Superintendents	1	..	1
Surveyors	1	..	1
Tailors	4	..	4
Teachers .....	..	5	5
Waiters	1	..	1
Wallpaper typers	1	..	1
Watchmen	1	..	1
Weavers	6	2	8
Woodcarvers	1	..	1
Writers	1	..	1
No occupation	23	27	50
Unascertainable	9	..	9
Total	300	296	596

TABLE IX.

MENTAL DISEASE OF THOSE ADMITTED.

<i>Mental Disease.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
INTOXICATION PSYCHOSIS :			
Acute Alcoholism, Intolerance .....	..	1	1
Chronic Alcoholism	15	6	21
Chronic Alcoholism, Acute Hallucinatory Dementia.	4	..	4
Chronic Alcoholism, Chr. Hallucinatory Dementia.	2	..	2
Chronic Alcoholism, Delirium Tremens	4	..	4
Morphinism	1	1	2
INFECTION PSYCHOSIS	1	1
EXHAUSTION PSYCHOSIS	1	1	2

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<i>Mental Disease.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
DEMENTIA PARETIC:			
Depressive Form.....	12	4	16
Expansive Form.....	18	6	24
Agitated Form.....	5	2	7
Demented Form.....	9	2	11
DEMENTIA ORGANIC:	5	10	15
Cerebral Trauma.....	1	..	1
ARTERIOSCLEROTIC PSYCHOSIS	4	2	6
DEMENTIA SENILE	22	28	50
PRESENILE DELUSIONAL PSYCHOSIS	2	3	5
DEMENTIA PREGOX:			
Simplex	3	4	7
Hebephrenic.....	28	23	51
Depressive with Delusional Formation.....	1	4	5
Agitated Form.....	3	2	5
Periodic Form.....	..	1	1
Katatonic Form.....	9	32	41
Paranoides Gravis.....	40	28	68
Paranoides Mitis.....	21	15	36
PARAPHRENIA:			
Systematica.....	..	3	3
PARANOIA	1	..	1
EPILEPTIC PSYCHOSIS	11	5	16
MANIC DEPRESSIVE PSYCHOSIS:			
Manic Phase.....	34	45	79
Depressed Phase.....	23	42	65
Mixed Phase.....	4	10	14
INVOLUTIONAL MELANCHOLIA	1	6	7
PSYCHO-NEUROSES:			
Hysterical Psychosis.....	2	..	2
DEGENERATION PSYCHOSIS:			
Constitutional Inferiority.....	3	2	5
Sexual Perversion.....	1	..	1
ARRESTED PSYCHICAL DEVELOPMENT:			
Imbecility, Low Grade.....	4	2	6
Imbecility, Middle Grade.....	3	3	6
Imbecility, High Grade.....	2	2	4
Total	300	296	596

TABLE X.

MANNER OF SUPPORT OF THOSE ADMITTED.

<i>How Supported.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
State	78	99	177
County	153	136	289
Private	69	61	130
Total.....	300	296	596

TABLE XI.

ALLEGED CAUSE OF INSANITY OF THOSE ADMITTED.

<i>Cause.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
PHYSICAL:			
Arteriosclerosis.....	2	..	2
Cerebral apoplexy.....	..	1	1
Cerebral changes.....	..	1	1
Cerebral hemorrhage.....	1	..	1
Climacteric .....	..	11	11
Congenital	1	..	1
Environment.....	1	..	1
Epilepsy.....	7	2	9
General ill health.....	..	3	3
Hemiplegia.....	1	..	1
Heredity.....	5	17	22
Intemperance and other excesses.....	35	12	47
Malarial fever.....	1	..	1
Masturbation.....	10	1	11
Menstrual irregularities.....	..	3	3
Overwork.....	5	4	9
Predisposition.....	5	4	9
Puberty.....	..	1	1
Puerperium .....	..	6	6
Senility.....	9	13	22
Syphilis.....	16	3	19
Toxic	2	..	2
Traumatism.....	5	1	6
Total.....	106	83	189
MORAL:			
Disappointed affections.....	1	5	6
Domestic troubles.....	2	5	7

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<i>Cause.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Financial reverses.....	3	2	5
Grief.....	1	3	4
Religious excitement.....	3	11	14
Shock.....	2	4	6
Worry.....	15	10	25
	<hr/>	<hr/>	<hr/>
Total.....	27	40	67
Total physical.....	106	83	189
Total moral.....	27	40	67
Unassigned.....	167	173	340
	<hr/>	<hr/>	<hr/>
Total.....	300	296	596

TABLE XII.

COMPLICATIONS OF THOSE ADMITTED.

<i>Complications</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
GENERAL DISEASES:			
Acne.....	3	..	3
Arthritis deformans.....	..	1	1
Deaf mute.....	1	..	9
Diabetes mellitus.....	3	1	4
Epilepsy.....	13	5	18
Epithelioma of face.....	..	1	1
Goitre.....	1	16	17
Malaria.....	1	..	1
Mastitis.....	..	2	2
Parotitis.....	..	1	1
Rheumatism.....	2	2	4
Syphilis.....	50	19	69
Rheumatoid arthritis.....	1	..	1
NERVOUS SYSTEM:			
Chorea.....	1	..	1
Diplegia.....	2	3	5
Facial tic.....	1	..	1
Hemiplegia.....	3	..	3
Locomotor ataxia.....	2	..	2
Neuritis.....	1	..	1
Paralysis.....	..	2	1
Paraplegia.....	1	..	1

<i>Complications</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
CIRCULATORY SYSTEM :			
Anemia.....	3	6	9
Arteriosclerosis.....	33	19	52
Endocarditis.....	3	27	30
Myocarditis.....	..	2	2
Varicose ulcers.....	..	3	3
Varicose veins.....	..	8	8
RESPIRATORY SYSTEM :			
Asthma.....	..	1	1
Bronchitis.....	2	4	6
Pneumonia.....	1	1	2
Pulmonary tuberculosis.....	1	4	5
DIGESTIVE SYSTEM :			
Artificial anus.....	1	..	1
Cirrhosis of liver.....	2	..	2
Carcinoma of rectum.....	1	..	1
Gastritis.....	3	1	4
Hernia.....	3	3	6
EYE, EAR, NOSE AND THROAT :			
Arcus senilis.....	1	2	3
Blindness (one eye).....	4	2	6
Blindness (total).....	4	2	6
Casts.....	1	..	1
Cataract.....	5	2	7
Color blind.....	1	..	1
Deafness.....	11	5	16
Hyperopia.....	..	1	1
Myopia.....	2	..	2
Ptosis of right eye.....	1	1	2
Strabismus.....	4	..	4
GENITO-URINARY SYSTEM :			
Chancroids.....	1	..	1
Cystitis.....	2	1	3
Hydrocele.....	1	..	1
Left testicle missing.....	1	..	1
Nephritis.....	83	34	117
Undescended testicles.....	2	..	2
GYNECOLOGICAL CONDITIONS :			
Fibro-myomata.....	..	2	2
Hysterectomy.....	..	2	2

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<i>Complications.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Lacerated cervix.....	..	1	1
Oophorectomy.....	..	2	2
Retroflexion of uterus.....	..	1	1
ACCIDENTAL TRAUMATISMS:			
Abrasions of wrists.....	..	1	1
Bruises.....	1	5	6
Contusions.....	1	..	1
Dislocation of hip.....	..	2	2
Fracture.....	4	..	4
Infection of ankles and wrists.....	..	1	1
Infection of arm and index finger of right hand.....	1	..	1
Lacerated wounds.....	6	3	9
Scars from burns.....	1	1	2
Second finger of right hand infected.....	1	..	1
Two bullets in brain (self inflicted).....	1	..	1
AMPUTATIONS AND DEFORMITIES:			
Amputation of fingers.....	4	..	4
Amputation of leg.....	2	..	2
Amputation of toes.....	..	1	1
Ankylosis.....	1	3	4
Chicken breast.....	1	2	3
Cleft palate.....	..	1	1
Clubbed fingers.....	..	1	1
Clubfoot.....	..	1	1
Contraction of left hand.....	..	1	1
Deformity of hand.....	1	..	1
Deformity of leg.....	5	..	5
Fingers of left hand stiff.....	1	..	1
Hands and feet frozen.....	1	..	1
Kyphosis.....	..	2	2
Lordosis.....	..	1	1
Nose deformed and burned.....	..	1	1
Part of right breast removed.....	..	1	1
Talipes varus.....	1	1	2
Tongue-tied.....	1	..	1
Homicidal tendencies.....	32	23	55
Suicidal tendencies.....	36	46	82
Without complications.....	118	119	237

In this table patients who had a number of complications have been noted more than once; the total is therefore omitted, because it would have no statistical value.

TABLE XIII.

HEREDITY OF THOSE ADMITTED.

<i>Heredity.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Insanity in family.....	47	66	113
Hereditary taint denied.....	108	106	214
Hereditary history unascertainable.....	145	124	269
Total.....	300	296	596

TABLE XIV.

DURATION OF MENTAL DISEASE BEFORE ADMISSION.

<i>Duration.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Under one month.....	67	69	136
One to three months.....	62	64	126
Three to six months.....	29	26	55
Six to twelve months.....	26	35	61
One to two years.....	29	20	49
Two to three years.....	14	12	26
Three to four years.....	12	10	22
Four to five years.....	4	7	11
Five to ten years.....	10	16	26
Ten to twenty years.....	4	7	11
Over twenty years.....	4	3	7
Unascertainable.....	39	27	66
Total.....	300	296	596

TABLE XV.

AGE WHEN FIRST ATTACKED OF THOSE RESTORED.

<i>Age.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Under fifteen years.....	2	1	3
Fifteen to twenty years.....	2	5	7
Twenty to twenty-five years.....	4	5	9
Twenty-five to thirty years.....	4	4	8
Thirty to thirty-five years.....	3	8	11
Thirty-five to forty years.....	3	1	4
Forty to forty-five years.....	3	4	7
Forty-five to fifty years.....	2	1	3
Fifty to sixty years.....	5	2	7
Over sixty years.....	1	..	1
Unascertainable.....	17	17	34
Total.....	46	48	94

TABLE XVI.

DURATION BEFORE ADMISSION OF THOSE RESTORED.

<i>Duration.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Under one month.....	21	22	43
One to three months.....	9	10	19
Three to six months.....	3	7	10
Six to twelve months.....	3	..	3
One to two years.....	2	1	3
Over two years.....	5	5	10
Unascertainable	3	3	6
Total.....	46	48	94

TABLE XVII.

DURATION OF TREATMENT OF THOSE RESTORED.

<i>Duration.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Under one month.....	2	..	2
One to two months.....	6	5	11
Two to three months.....	7	4	11
Three to four months.....	4	8	12
Four to five months.....	4	..	4
Five to six months.....	..	6	6
Six to nine months.....	6	12	18
Nine to twelve months.....	4	4	8
Twelve to eighteen months.....	5	5	10
Eighteen to twenty-four months.....	2	1	3
Over two years.....	6	3	9
Total.....	46	48	94

TABLE XVIII.

MENTAL DISEASE OF THOSE RESTORED.

<i>Mental Disease.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
INTOXICATION PSYCHOSIS:			
Chronic alcoholism.....	12	4	16
Chronic alcoholism, acute hallucinatory dementia...	2	..	2
Chronic alcoholism, delirium tremens.....	3	1	4
Morphinism.....	..	2	2
Trional.....	1	..	1
INFECTION PSYCHOSIS.....	..	1	1
DEMENTIA PRECOX:			
Agitated form.....	..	1	1
Hebephrenic.....	3	3	6
Katatonic.....	2	1	3
Paranoides mitis.....	1	..	1
MANIC DEPRESSIVE PSYCHOSIS:			
Manic phase.....	14	21	35
Depressed phase.....	6	10	16
Mixed phase.....	..	1	1
INVOLUTIONAL MELANCHOLIA.....	2	3	5
Total.....	46	48	94

TABLE XIX.

AGE AT DEATH.

<i>Age.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Ten to twenty years.....	..	1	1
Twenty to twenty-five years.....	1	5	6
Twenty-five to thirty years.....	3	3	6
Thirty to thirty-five years.....	9	6	15
Thirty-five to forty years.....	11	11	22
Forty to forty-five years.....	21	9	30
Forty-five to fifty years.....	17	6	23
Fifty to sixty years.....	19	22	41
Sixty to seventy years.....	22	20	42
Seventy to eighty years.....	22	14	36
Eighty to ninety years.....	7	8	15
Over ninety years.....	..	3	3
Total.....	132	108	240

TABLE XX.

MENTAL DISEASE OF THOSE WHO DIED.

<i>Mental Disease.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
INTOXICATION PSYCHOSIS:			
Acute alcoholism, intolerance.....	..	1	1
Chronic alcoholism, alcoholic paranoia.....	1	..	1
Chronic alcoholism, delirium tremens.....	1	..	1
Chronic alcoholism, Korsakow's.....	1	..	1
Chronic alcoholism, acute hallucinatory dementia...	1	..	1
Chronic alcoholism, chronic hallucinatory dementia.	4	..	4
EXHAUSTION PSYCHOSIS	1	1	2
DEMENTIA PARETIC:			
Depressed form.....	4	..	4
Expansive form.....	16	2	18
Agitated form.....	3	1	4
Demented form.....	19	4	23
DEMENTIA ORGANIC.....	10	8	18
DEMENTIA SENILE	36	34	70
PRESENILE DELUSIONAL INSANITY .....	..	2	2
DEMENTIA PRECOX:			
Hebephrenic.....	4	4	8
Katatonic form.....	3	9	12
Paranoides gravis.....	3	9	12
Paranoides mitis.....	1	1	2
PARANOIA	1	2	3
EPILEPTIC PSYCHOSIS	3	3	6
MANIC DEPRESSIVE PSYCHOSIS:			
Manic Phase.....	11	13	24
Depressed phase.....	5	9	14
Mixed phase.....	1	1	2
INVOLUTIONAL MELANCHOLIA .....	..	3	3
ARRESTED PSYCHICAL DEVELOPMENT:			
Imbecility, low grade.....	1	..	1
Imbecility, middle grade.....	2	1	3
Total.....	132	108	240

TABLE XXI.

<i>Cause.</i>	CAUSE OF DEATH.		<i>Men</i>	<i>Women</i>	<i>Total</i>
INTOXICATION PSYCHOSIS:					
With acute cardiac dilatation.....	2	..	2		
With broncho-pneumonia.....	1	..	1		
With cardiac exhaustion.....	2	..	2		
With chronic interstitial nephritis.....	2	1	3		
With lobar pneumonia.....	1	..	1		
EXHAUSTION PSYCHOSIS:					
With acute parenchymatous nephritis; uremic convulsions.....	1	..	1		
With lobar pneumonia.....	..	1	1		
DEMENTIA PARETIC:					
With acute peritonitis.....	1	..	1		
With broncho-pneumonia.....	7	..	7		
With cardiac exhaustion.....	2	..	2		
With cerebral apoplexy.....	..	1	1		
With cerebral hemorrhage.....	..	2	2		
With chronic nephritis.....	2	..	2		
With convulsions.....	20	1	21		
With exhaustion.....	7	..	7		
With lobar pneumonia.....	1	3	4		
DEMENTIA ORGANIC:					
With arteriosclerosis; mitral insufficiency.....	..	1	1		
With cerebral apoplexy.....	..	4	4		
With cerebral hemorrhage.....	3	1	4		
With chronic albuminous nephritis.....	1	..	1		
With chronic endocarditis.....	1	..	1		
With exhaustion.....	1	..	1		
With infected calculus of liver.....	1	..	1		
With lobar pneumonia.....	3	2	5		
DEMENTIA SENILE:					
With broncho-pneumonia.....	3	1	4		
With carcinoma of breast.....	..	1	1		
With cardiac exhaustion.....	7	..	7		
With cerebral apoplexy.....	1	3	4		
With cerebral hemorrhage.....	2	3	5		
With chronic endocarditis.....	3	2	5		
With chronic endocarditis; arteriosclerosis.....	1	..	1		
With chronic endocarditis; mitral regurgitation.....	..	1	1		

<i>Cause.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
With chronic interstitial nephritis; chronic endocarditis	1	1	2
With myocarditis.....	1	2	3
With chronic nephritis.....	5	3	8
With diarrhea; enteritis.....	..	1	1
With exhaustion.....	1	3	4
With gangrene of legs; exhaustion.....	..	1	1
With lobar pneumonia.....	11	11	22
With myocarditis; chronic interstitial nephritis.....	..	1	1
PRESENILE DELUSIONAL PSYCHOSIS:			
With broncho-pneumonia.....	..	1	1
With cerebral hemorrhage.....	..	1	1
DEMENTIA PRECOX:			
With chronic endocarditis.....	1	..	1
With acute myocarditis.....	..	1	1
With aortic regurgitation.....	..	1	1
With apoplectic convulsions.....	..	1	1
With broncho-pneumonia.....	..	3	3
With broncho-pneumonia; chronic interstitial nephritis.....	1	..	1
With carcinoma of uterus.....	..	1	1
With chronic endocarditis; chronic interstitial nephritis.....	1	..	1
With chronic interstitial nephritis.....	2	3	5
With diabetes mellitus.....	1	..	1
With double empyema.....	1	..	1
With exhaustion.....	..	2	2
With lobar pneumonia.....	4	4	8
With pulmonary tuberculosis.....	..	6	6
With pulmonary tuberculosis; chronic interstitial nephritis.....	..	1	1
PARANOIA:			
With chronic interstitial nephritis.....	..	1	1
With lobar pneumonia.....	1	1	2
EPILEPTIC PSYCHOSIS:			
With broncho-pneumonia.....	2	..	2
With convulsions.....	1	..	1
With status epilepticus.....	..	3	3
MANIC DEPRESSIVE PSYCHOSIS:			
With acute cardiac dilatation.....	..	1	1
With acute myocarditis.....	..	1	1
With acute nephritis.....	1	..	1

<i>Cause.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
With broncho-pneumonia.....	..	5	5
With cardiac exhaustion.....	4	1	5
With cerebral apoplexy.....	1	1	2
With cerebral hemorrhage.....	1	..	1
With chronic endocarditis.....	..	1	1
With chronic endocarditis; chronic nephritis.....	2	..	2
With chronic endocarditis; exhaustion.....	..	1	1
With chronic nephritis.....	3	1	4
With exhaustion.....	1	3	4
With lobar pneumonia.....	2	5	7
With mitral regurgitation.....	..	1	1
With pulmonary tuberculosis.....	1	1	2
With suicide by hanging.....	1	..	1
With volvulus of intestines.....	..	1	1
INVOLUTIONAL MELANCHOLIA:			
With endocarditis; mitral regurgitation.....	..	1	1
With lobar pneumonia.....	..	1	1
With pulmonary tuberculosis.....	..	1	1
ARRESTED PSYCHICAL DEVELOPMENT:			
With cerebral hemorrhage.....	..	1	1
With chronic interstitial nephritis.....	1	..	1
With diabetes mellitus; chronic endocarditis.....	1	..	1
With lobar pneumonia.....	1	..	1
Total.....	132	108	240

TABLE XXII.

SHOWING YEARLY INCREASE IN POPULATION SINCE OPENING OF INSTITUTION.

<i>Year.</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>	<i>Increase</i>
October 31st, 1876.....	159	183	342	...
October 31st, 1877.....	216	229	445	103
October 31st, 1878.....	227	253	480	35
October 31st, 1879.....	248	279	527	47
October 31st, 1880.....	277	309	586	59
October 31st, 1881.....	310	331	641	55
October 31st, 1882.....	321	346	667	26
October 31st, 1883.....	330	377	707	40
October 31st, 1884.....	371	374	745	38
October 31st, 1885.....	415	414	829	84
October 31st, 1886.....	415	441	856	27
October 31st, 1887.....	434	439	873	17
October 31st, 1888.....	463	441	904	31
October 31st, 1889.....	427	430	857	...
October 31st, 1890.....	450	436	886	29
October 31st, 1891.....	455	443	898	12
October 31st, 1892.....	471	478	949	51
October 31st, 1893.....	509	500	1009	60
October 31st, 1894.....	520	530	1050	41
October 31st, 1895.....	541	575	1116	66
October 31st, 1896.....	538	550	1088	...
October 31st, 1897.....	593	584	1177	89
October 31st, 1898.....	618	618	1236	59
October 31st, 1899.....	658	644	1302	66
October 31st, 1900.....	696	693	1389	87
October 31st, 1901.....	707	683	1390	1
October 31st, 1902.....	729	732	1461	71
October 31st, 1903.....	744	761	1505	44
October 31st, 1904.....	789	812	1601	96
October 31st, 1905.....	834	840	1674	73
October 31st, 1906.....	872	907	1779	105
October 31st, 1907.....	917	907	1824	45
October 31st, 1908.....	993	950	1943	119
October 31st, 1909.....	1050	1009	2059	116
October 31st, 1910.....	1093	1025	2118	59
October 31st, 1911.....	1131	1079	2210	92
October 31st, 1912.....	1170	1132	2302	92
October 31st, 1913.....	1225	1186	2411	109
October 31st, 1914.....	1261	1248	2509	98
October 31st, 1915.....	1335	1334	2669	160
October 31st, 1916.....	1332	1356	*2688	19

*Fifty-two patients transferred to the New Jersey State Village for Epileptics at Skillman.

NOTE.—In all indigent cases where inquiry has not been held, or final Court order has not been received, the patients are credited to the County from which they were sent.

SUMMARY

<i>Class</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
Indigent	718	779	1,497
State indigent	427	407	834
Private	100	158	258
Convict	63	5	68
Criminal	24	7	31
	<hr/>	<hr/>	<hr/>
Total	1,332	1,356	2,688

PATIENTS STRIPPING WILLOWS, FOR MAKING FURNITURE, BASKETS, ETC.
THE WILLOWS ARE GROWN ON THE HOSPITAL GROUNDS

REPORT OF THE WARDEN.

Warden's Report.

To the Board of Managers,

Gentlemen: The annual report of the business department of the institution, embodying detailed accounts of the mechanical and other branches, for fiscal year ending October 31, 1916, is respectfully presented.

Improvements to buildings, grounds, power plant and equipment, also in the operation of the various departments, have been made.

Appropriations for buildings, etc., were made available during the year, all of which have been constructed or delivered, with the exception of the item of water main for an independent line to the high service reservoir, which was allowed to lapse.

This course was found to be advisable, as the advance in cost of materials between the time appropriation was asked for and date when available, increased the cost beyond the appropriation.

The addition to fire house is in course of construction; inability to secure iron work delayed the work.

The material is on hand for silo; the work of building will be done by the hospital force.

Contracts were placed for machinery for the machine shop. Owing to difficulty in obtaining lathes, etc., the contractor will be unable to deliver until approximately November 15th.

Contracts have been awarded for roofs on the kitchen and tuberculosis buildings.

Contract has been awarded for electric elevator for Dormitory Building kitchen.

There are a number of items included in the list of appropriations asked for that were not provided; others partially.

These will be included with other items for further consideration of the Legislature.

Tomatoes from the garden were canned with the new canning plant, and the results obtained were entirely satisfactory.

FIRE ALARM AND WATCH CLOCK SERVICE.

The required fire alarm boxes, electric watch clock stations, conduits, cable, etc., were purchased with money appropriated for the purpose, and the laying of conduit, wiring, and installation of boxes and stations, is being done by the hospital electrician.

The completion of these extensions to the systems will insure better fire protection and supervision of buildings.

The finishing of this very important work is being delayed owing to lateness of delivery of a portion of the material.

HEATING EQUIPMENT.

The work of removing defective piping, etc., making improvements in the heating system and installation of new materials, has been continued throughout the year.

The erection of new buildings each year enlarges and extends the system, increasing, necessarily, the volume of repairs.

To complete the work of removing old and defective material throughout the ducts and buildings, and to procure required steam traps, etc., to provide for the finishing of necessary improvements, material is required and should be provided for.

FIRE PROTECTION.

Thirty-six fifty-foot lengths of hose were purchased and installed, replacing defective hose and equipping additional stand-pipes upon the wards in the Administration Building.

Additional hose for replacing worn hose upon the trucks, also fire extinguishers in the various buildings, are needed.

DISTRIBUTION OF FOOD FROM KITCHENS.

The introduction and use of enclosed food cars for the distribution of food to the wards, dining rooms, etc., is a very satisfactory improvement over previous methods.

The new cars are so constructed as to require less floor space and are shorter and narrower than the old type. These features, while not constituting the entire change, reduce the weight, and make easier their transmission through the ducts or passageways, which in places are narrow, and where progress is difficult.

These cars are fully enclosed, are heated with live steam, and the food is kept hot and free from contamination while en route from the kitchen to the point of delivery.

The food elevators are operated by hand. They alone are heavy, and when filled with food are extremely hard to operate, and the difficulty in securing and keeping men for the work is responsible for the constant shortage of help in the kitchens.

The elevators should be electrically operated, thus reducing the number of men required to operate them, insure good delivery service (which is now impossible), eliminate the breakage of dishes, destruction of foods and wrecking of elevators, which occurs when the men hoisting the elevators lose control and elevators and contents drop to the bottom of the shaft.

LAUNDRY.

The work in this very necessary and highly important department continues to increase, and the new machinery, for which an appropriation is available during the ensuing year will replace a portion of the equipment which is incapable of disposing of the mass of work, on account of its worn-out condition.

The amount asked for was not granted, but the money available will aid very materially in placing the laundry upon a more efficient basis.

The need of an elevator at the laundry was mentioned last year, but was not provided for. The elevator now in use is kept constantly in operation, disposing of clothing to be sent out to the various wards. It operates between the laundry and cable car platform in the subway, was constructed for handling one-half the amount of clothing etc., now laundered, is belt driven, exceedingly slow in operation, too small and unsafe. As many

safeguards as it has been possible to provide have been installed upon advice of the Department of Labor.

Upon the grounds of safety and efficiency, a new elevator should be installed.

REFRIGERATION FOR DORMITORY BUILDING.

Food for supplying eight hundred persons is stored and prepared at the Dormitory Building.

Ice is stored in bunkers at this building for refrigeration purposes; the system is crude, expensive and unsatisfactory.

The bunkers in which ice is placed do not produce the proper efficiency, are now in condition which necessitates constant repair.

Ice is carted from the ice house, a distance of one-half mile, and much is lost while in transit.

The installation of an equipment for refrigeration purposes will provide for efficiency and reduce present cost of handling and carting of ice, and continuous repairs to the ice bunkers.

A plant should be installed at this building to relieve the existing conditions which are unsatisfactory and expensive.

SHOP BUILDING.

The room formerly occupied by the painting department was located in the basement of the Administration Building, directly underneath the wards. This space was occupied for some years, and finally on account of danger from fire (a number of fires occurred and were extinguished, fortunately without serious damage) this department was removed to a shop which was constructed near the mechanical department.

This location was later taken over for the cold storage equipment, and again the department was moved, this time to the basement of the Dormitory Building, where on account of a more suitable place not being available, it is now working.

The quantity of materials necessary for the increasing work is greater than formerly, and the danger from fire more pronounced.

This very important and necessary branch of the service must be maintained, and a suitable building of proper construction should be provided, situated so that in case of fire, the lives of patients and employees will not be endangered.

EQUIPMENT FOR MECHANICAL DEPARTMENT.

The mechanical departments are partially equipped with machinery, etc. from moneys appropriated. The amount provided was less than asked for, consequently the entire apparatus, tools, etc. needed could not be purchased.

The institution is removed from all well-equipped shops where it might be possible to have work done, and must rely upon its own resources.

Work that could be produced here at a reduced cost, if shops were properly equipped, must be sent to some distant point at great expense in most cases, and also loss of time.

No mistake will be made in providing for the necessary machines, tools, etc. with which to properly equip the departments for prompt and efficient service at reduced cost and saving in time.

WATER SUPPLY.

Ample water has been available during the greater part of the year. In the latter months the supply has fallen off rapidly, and with the close of the year all reservoirs contain much less than the normal quantity.

The necessity of greater storage capacity is emphasized, and an appropriation for an additional reservoir as asked for last year should be provided.

The artesian well was drilled to a depth of 305 feet, a greater portion of the distance through solid rock. The quantity of water available when drilling of well was completed, was approximately 47 gallons per minute; during a dry season this quantity will naturally be reduced.

To become available for use, a pump must be installed and water from well delivered into the water main now supplying the cottages in the vicinity of the dairy; also the dairy.

The mountain spring has given a continuous supply, meeting all demands for drinking purposes. Analysis of the water at regular intervals, by the State Board of Health, show it to be free from pollution.

The materials in filter house at the lower reservoir in garden have been removed, filter thoroughly cleansed and replaced with a fresh supply. All remaining filters will be renovated as rapidly as water conditions and weather will permit.

The water purification plants, three in number, recently installed and placed in operation, have not been operating satisfactorily, difficulty being experienced with motors, pumps, etc.

NURSERY.

Four acres of land were set aside and are devoted to the raising of seedlings, which will later be planted upon the water shed to replace the chestnut timber.

Six varieties, Douglas fir, white pine, Austrian pine, white spruce, Norway spruce and red pine seedlings, aggregating 425,000 were purchased, and on account of lateness in delivery, unfavorable weather conditions, lack of help and a great amount of other work, it was found to be impossible to properly handle them in the time required to insure life and growth.

The State Forestry Department furnished names of prospective buyers, and advised that as many seedlings as possible be disposed of.

The same conditions existing at the hospital were being experienced by these people, and as a result, the quantity disposed of was small.

The nursery has been given but little care, as the men could not be secured to do the work.

The prospect for good results are, however, promising, and with the opening of spring it will be possible, help being available, to develop the nursery, upon which the successful conservation of the available water upon the shed in a marked degree depends.

GAS PLANT.

Gas is used for cooking purposes, also in the infirmaries for preparing or warming foods for the sick.

The gas plant is run in conjunction with the pumping plant, consequently the cost of operating the plant is reduced.

One bench of retorts is worn out and the remaining retorts have been in use for some months.

The worn-out retorts should be torn out and renewed as early as possible, and later the remaining retorts (now in use) renewed.

HOSPITAL SWITCH.

To relieve as much as possible the dangerous condition of the hospital switch, a quantity of rail, etc. was purchased from the house funds as mentioned in report of last year.

An appropriation of \$6,100 for railroad equipment was requested, and \$3,000 was allowed, available during fiscal year ending October 31, 1917.

This amount is only one-half the money required, and owing to the continuous advance in cost of materials, the money made available is insufficient, and not less than \$3,500 additional should be provided in order that this very important matter which involves the safety of human lives, can be disposed of.

STORAGE CAPACITY FOR COAL.

The very important question of keeping in reserve a sufficient quantity of coal to protect the institution from the serious consequences which would result in the event of lack of coal for operating the heating and power plant, has been discussed in previous reports.

While the tonnage consumed daily has increased, owing to the addition each year of buildings to be heated and lighted, no provision has been made to care for the coal which should be procured during the summer months, when the quantity used is the lightest, for use during the winter.

The coal company each year advises and requests that the hospital bank as much coal as possible before cold weather sets in, as they will not guarantee delivery in winter, at which time the mines are not running at full capacity and heavy storms interfere with and retard shipments.

The required amount to carry the institution through the cold season cannot be stored, and should the coal company fail to deliver throughout this period, the result can readily be foreseen.

This is one of the items which requires attention and should be provided for.

FARM.

Difficulty in securing help, and the lack of men to properly perform the work in connection with the farm made it impossible to operate successfully, and the shortage in production results not only from the unfavorable weather conditions which prevailed, but from this cause also. The lateness of the season retarded and prevented early work, the effect of which was evident throughout the entire time. This was followed by excessive rainfalls at intervals, which, while aiding the grass, seriously affected wheat, rye and corn. Wheat and rye sprouted before it was possible to harvest it.

The hay yield was greater than of last year, the result of generous top dressing and favorable rains.

The usual acreage of silage corn was planted, but the greater part so late that it did not mature, consequently the quantity of ensilage is below former years; inability to properly cultivate on account of insufficient help is also responsible.

Eight acres were planted in mangel-wurzels; double that of last year. Being unable to cultivate reduced the yield, and it will require the combined silage and beet crop to supply the dairy during the winter.

The yield of green fodder during the summer months aided very materially in keeping the daily milk production up to a fair average.

DAIRY.

The general conditions at the dairy are, when the difficulties prevalent during the year are considered, exceptionally good.

Inability to retain milkers, even at increased wages, absence of competent men to replace those leaving, made difficult and at times impossible, regulation of the work and proper results. Many times the force was badly depleted, leaving three men struggling along in an effort to perform the work of six. The men worked long hours, could not milk thoroughly, and had little time to devote to the cleanliness of cows, stable or equipment.

Later in the season the applications for work increased, and with the close of the year, this department is in good shape.

Seventy-six cows were purchased and eighty slaughtered for food during the year. Of the latter, all were inspected by a competent veterinarian appointed by the State Department of Health, and sixty-five carcasses were passed for food.

One consignment of cows purchased at Buffalo had apparently been exposed before shipment, or while en route, a number developed pneumonia and within a few hours after arrival were seriously ill; later four died.

Subsequently one cow of a number obtained at Buffalo by a dealer, contracted the disease prior to her arrival at the hospital, this case recovered.

The acquiring of cows in the market free from disease, of good size and quality is becoming difficult, if not impossible, and good prices are being paid for animals of fair quality only.

The only successful method of acquiring a clean herd, and a dairy of good quality is by breeding.

Grazing land is not available and the cows are not pastured. Lack of pasture land and sufficient room makes this impossible on a scale sufficient to supply the dairy.

Under these unfavorable conditions, however, a few heifers are being raised to maturity each year.

I recommend that fifty acres of pasture land be purchased.

The system of ventilation approved when the old dairy barn was constructed is not efficient.

To promote and preserve the health of cows, an approved modern system should be installed.

In a crude way, the best, however available, milk pails and other equipment are being sterilized in an effort to furnish to the

inmates, pure milk. All utensils, pails, cans, bottles, cooler, etc. should be sterilized regularly and thoroughly at the dairy. Hot water should be furnished for the use of employees, to insure cleanliness, which is indispensable in the dairy.

The modern method of bottling milk should be adopted, and the ancient practice of using cans which, when they become worn, are extremely difficult to keep in a sanitary condition, discontinued.

Milk is dipped or poured from the cans in which it is delivered at the building, into pails or other receptacles, and then distributed to the various wards in the several buildings.

Milk bottled at the dairy can be delivered to the various wards, free from contamination, danger of which exists under the present conditions.

A building equipped with steam boiler and other necessary appliances to properly sterilize all equipment, and in addition, a bottling machine, are urgently recommended.

GARDEN.

Two very necessary requirements to insure a successful year, viz.; favorable weather and sufficient help, were lacking.

While the quantity of vegetables produced and served was not as liberal as that of last year, there was a generous supply.

The beets, carrots, parsnips, turnips, etc., which have been buried in an effort to preserve them for use during the winter months, cannot be successfully kept by this method.

A root cellar has been recommended to relieve the situation which must necessarily be of large dimensions to accommodate the roots for winter consumption.

A considerable quantity of vegetables is lost each winter, and during exceptionally severe weather the waste has been heavy, entailing not only a loss financially, but in addition, depriving the patients of the food that is appreciated and which is, on account of the advanced cost of articles of food purchased, very valuable.

This item deserves consideration and an appropriation should

be made available for materials with which to construct it during the coming summer, to be ready for use in the winter months.

FENCING.

The fences, a portion of which are post and rail, the balance picket, enclosing several portions of the hospital property, were constructed years ago, have been repaired each year for some time, and many are now in such condition that renewal is necessary.

Posts for new fences can be supplied from chestnut timber cut off the hospital property.

Heavy wire fencing will be the most economical and satisfactory from the point of cost, efficiency and durability.

PIGGERY.

The year has been a successful one in breeding and raising pigs. While the conditions are not favorable for carrying on this industry on a large scale, it is probable that a sufficient number to consume the waste material can be successfully raised in the future.

At the close of the year the herd of stock bred totals 172; a considerable number are now of good size.

One hundred shoats were purchased from the hospital at Trenton for the purpose of having a sufficient number to consume all table refuse.

Cholera did not develop during the year, which may be due in part to the preventive measures employed. All pens are thoroughly cleansed each day and regularly disinfected.

The installation of the incinerator adds live steam to the equipment at the plant, which will be a valuable aid in cleansing the pens and implements used.

Fifty-two hogs bred and raised at the piggery dressed when slaughtered 14,456 pounds.

INCINERATOR.

The incinerator, installation of which was completed during October, was subjected to a test during the latter part of the month and proved satisfactory.

The plant is being operated successfully by the man in charge at the piggery, with the assistance of a helper. A considerable quantity of wet garbage is successfully destroyed daily without odor.

One of the horses at work in the garden died suddenly; the carcass was readily disposed of at the incinerator.

The objectionable odor from the pits in which garbage was for years dumped, is eliminated as well as the expense of excavating for pits, and the land is available for cultivation.

Waste paper and rags sent to the incinerator will be assorted, baled and sold.

This work will be done by the extra man employed to assist in the destruction of refuse, etc., and it is estimated that the revenue derived from the sale of paper and rags will reduce, materially, the expense of operating the incinerator.

ROADS.

Five miles of driveways and roads, portions of which are upon the property, others adjacent to the hospital grounds, have been kept in repair by the institution during the year.

The main driveway, extending from a point at the entrance to the property, to the front of the Administration Building, is of macadam construction. The driveway in rear of the Administration Building, and extending to the Dormitory Building; also road from front of this building around southern end, to the entrance to the garden, are of macadam. The latter two have been repaired with top dresser of native rock collected from the ground under cultivation. This rock is soft and will not wear well, necessitating considerable work to keep the roads in fair condition. Originally, the surface of the main driveway was treated with trap rock, which was of good wearing quality and until worn out gave excellent service.

The remainder, dirt roads, have been kept in repair by the institution with ashes from the power plant.

Dirt roads should be replaced with others more durable, and the present macadam driveways given a dressing of trap rock.

SEWAGE DISPOSAL.

The proper disposal of sewage from the various buildings has been for a number of years a serious problem, and of late becomes more so.

Attention has been directed in the yearly reports to this very important matter, and earnest consideration should now be given it.

The winter months of 1915-16 were not favorable for satisfactory results, owing to the excessive rainfall, the filtration beds being overtaxed with sewage; the water adding to the excessive work to which they were subjected keeping the beds flooded the greater part of the time, making it at times extremely difficult, and often impossible, to put them in such condition as is required to perform efficient work.

Freezing weather added to the difficulties, and when spring opened, the beds were not in dependable condition.

Excessive rainfalls during the spring and summer months have kept the beds in the same unsatisfactory condition, as it has not been possible to properly renovate them, although as often as available they have been thoroughly plowed and harrowed. Seldom was it possible to allow them to remain exposed to the sun and air for even a short time, as they must be kept in constant use.

Were it not for the utilization of approximately ten acres of ground for surface filtration, upon which the effluent from a portion of the Administration and Dormitory buildings is directed, daily during such periods of the year when the ground will readily absorb it, the system would have failed in its purpose.

The seven filtration beds are inadequate in capacity, owing principally to the material of which a portion are constituted. Two of the beds are to a great extent of clay formation and the filtration is, therefore, necessarily slow.

Upon request to the Department of Charities and Corrections, arrangements were made with Professor Charles McMillan, Consulting Engineer of the Department, for an inspection of the system, and report on same with recommendations for such additions and changes as are necessary to accommodate present and future requirements. Professor McMillan made an inspection and report, with estimate of the probable cost of the changes recommended by him.

ANNUAL INVENTORY AND APPRAISEMENT OF REAL ESTATE AND PERSONAL PROPERTY.

An appraisement of the real estate and personal property as inventoried shows an increased value over that of last year. The real estate is valued at \$3,499,149.00; personal property, \$430,641.81.

Mr. John Naughton and Mr. H. A. Van Gilder, of Morristown assisted in the appraisal, rendering valuable services.

Respectfully submitted,

ORLANDO M. BOWEN,

Warden.

Abstract of Receipts and Earnings and Expenses for the Fiscal Year Ending October 31, 1916.

RECEIPTS AND EARNINGS.

Balance in hands of State Treasurer Oct. 31, 1915, as per annual report,.....		\$317.07
Allowance from State Treasurer for support of Indigent Patients:		
State County,.....	172,555.06	
State Indigent,.....	175,613.08	
State Convict,	16,831.86	365,000.00
From Bergen County,.....		28,202.77
From Essex County,.....		30.80
From Hunterdon County,		4,500.07
From Hudson County,.....		11,721.95
From Mercer County,.....		27.82
From Morris County,		20,741.11
From Monmouth County,.....		358.08
From Middlesex County,.....		152.79
From Passaic County,.....		62,791.68
From Sussex County,		6,660.64
From Somerset County,.....		43.43
From Union County,.....		41,886.15
From Warren County,		9,517.94
From Private Patients,.....		97,899.37
From Miscellaneous Earnings,.....		7,427.16
From Account of Indigent and Convict Patients,.....		713.55
From Petty Expense Fund returned to State Treasurer,		2,000.00
		<u>\$659,992.38</u>

EXPENSES.

Employees' Pay Rolls,.....	\$213,100.94	
Bills and Refunds,.....	434,274.02	
Petty Expense Fund advanced to Warden,.....	2,000.00	649,374.96
Balance in hands of State Treasurer October 31, 1916,..		<u>\$10,617.42</u>

RESOURCES.

Amount due from Bergen County, October, 1916,.....	\$2,172.45	
Amount due from Essex County, May, June, 1911, December, 1913, February, March, April, May, June, July, August, September, October, 1914, April, December, 1915, May, September, October, 1916,....	891.67	
Amount due from Hudson County, September, October, 1916,.....	1,608.97	
Amount due from Hunterdon County, October, 1916,..	349.43	
Amount due from Middlesex County, October, 1916,...	8.86	
Amount due from Monmouth County, October, 1916,...	26.57	
Amount due from Passaic County, September, October, 1916,.....	9,139.80	
Amount due from Sussex County, October, 1916,.....	580.85	
Amount due from Union County, October, 1916,.....	3,600.77	
Amount due from Warren County, October, 1916,.....	740.69	19,120.06
Amount due from Private Patients,	15,501.03	
Clothing furnished during October, 1916,.....	1,598.67	
Due for hides, grease, etc.,	1,321.04	
Due for maintenance of patients for whom no orders have been received,	4,882.25	
Deficit account of maintenance of State Indigent patients, 1915,...	8,436.13	
Cash balance with State Treasurer,.....	10,617.42	
		<hr/> 61,476.60

LIABILITIES.

Bills payable outstanding,.....	10,403.27	
Excess Resources above Liabilities,.....	51,073.33	\$61,476.60

APPENDIX TO WARDEN'S REPORT.

Appendix to Warden's Report.

DAIRY AND FARM.

384,170 quarts milk (average number of cows milked, 153; average per cow per day, 10.16 quarts,).....	@ .07	\$26,891.90
44 calves sold,		318.53
303 tons hay,	20.00	6,060.00
15 tons rye straw,	14.00	210.00
5 tons wheat straw,	14.00	70.00
340 tons ensilage,	8.00	2,720.00
364 tons green fodder,	6.00	2,184.00
73½ bushels wheat,	1.50	110.25
234 bushels rye,	1.25	292.50
52 bushels apples, .....	.50	26.00
133 baskets plums, .....	.75	99.75
1,200 bushels mangel-wurzel beets, .....	.60	720.00
2.552 dozen eggs, .....	.55	1,403.60
		<u>\$41,106.53</u>

STOCK SLAUGHTERED AND USED AT THE HOSPITAL.

65 cows dressed, 41,840 lbs.,	@ .12½	\$5,334.60
27 calves dressed, 2,244 lbs., .....	.18	403.92
2 sheep dressed, 150 lbs., .....	.12	18.00
16 lambs dressed, 792 lbs., .....	.14	110.88
Chickens dressed, 201 lbs., .....	.18	36.18
30 pra. broilers,	1.50	45.00
139 hogs dressed, 31,777 lbs., .....	.12	3,813.24
		<u>\$9,761.82</u>

STATEMENT OF VEGETABLES AND FRUITS GROWN AND FURNISHED FROM GARDEN DURING THE FISCAL YEAR ENDING OCTOBER 31, 1916.

Asparagus, bunches,	809	@ .25	\$202.25
Beans, string, bushels,	463 29-32	.55	255.15
Beans, lima, bushels,	143 6-32	1.50	214.78
Beets, bunches,	368	.06	22.08
Beets, bushels,	174 31-32	1.00	174.97

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Cabbage, heads,.....	19,083	.10	1,908.30
Cauliflower, heads,	2,415	.10	241.50
Corn, sweet, ears,	137,354	.01½	2,060.31
Cucumbers,	9,163	.01½	137.45
Carrots, bunches,	153	.06	9.18
Carrots, bushels,	154 5-32	1.00	154.16
Celery, stalks,	255	.10	25.50
Egg plant,	4,807	.05	240.35
Kale, bushels,	477 26-32	.25	119.45
Lettuce, heads,	24,053	.05½	1,322.92
Onions, bushels,	101 26-32	1.00	101.81
Onions, bunches,	43,385	.02½	1,084.63
Peas, bushels,	166	1.10	182.60
Parsley, bunches,	8,064	.01	80.64
Peppers,	5,177	.02	103.54
Pumpkins,	3	.20	.60
Paranips, bushels,	60	1.00	60.00
Radishes, bunches,	4,584	.01½	68.76
Rhubarb, bunches,	18,234	.06	1,094.04
Squash,	244	.02	4.88
Squash, bushels,	25	.55	13.75
Spinach, bushels,	939	.60	563.40
Tomatoes, bushels,	4,679½	.80	3,743.60
Turnips, bushels,	26½	.75	19.88
Turnips, Rutabaga, bushels,	30	.75	22.50
Blackberries, quarts,	84	.10	8.40
Cherries, quarts,	677	.10	67.70
Currants, quarts,	526	.15	78.90
Gooseberries, quarts,	156	.10	15.60
Grapes, baskets,	285	1.00	285.00
Raspberries, quarts,	443	.15	66.45
Pears, bushels,	42	1.00	42.00
Strawberries, quarts,	5,849	.10	584.90

Forward..... \$15,381.93

VEGETABLES RAISED DURING YEAR ENDING OCTOBER 31, 1916, AND ON HAND
AT CLOSE OF YEAR.

	Forward.....	\$15,381.93
60 bushels beans, string,	@ .55	33.00
54 bushels beans, lima,	1.50	81.00
1,275 bushels beets,	1.00	1,275.00
30 bushels Brussels sprouts,	1.75	52.50
26,475 heads cabbage,10	2,647.50

NEW JERSEY STATE HOSPITAL.

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28,780 bunches celery,.....	.10	2,878.00	
1,477 bushels carrots,.....	1.00	1,477.00	
275 heads cauliflower,.....	.10	27.50	
3,500 ears corn, sweet,.....	.01½	52.50	
450 egg plant,.....	.05	22.50	
1,800 bushels kale,.....	.25	450.00	
6,850 leek,.....	.02	137.00	
18,250 heads lettuce,.....	.05½	1,003.75	
330 bushels onions,.....	1.00	330.00	
50 bushels onion sets,.....	3.00	150.00	
20,000 bunches onions,.....	.02½	500.00	
800 peppers,.....	.02	16.00	
1,580 bushels parsnips,.....	1.00	1,580.00	
15,000 bunches parsley,.....	.01	150.00	
150 pumpkins,.....	.20	30.00	
275 bunches sage,.....	.02	5.50	
750 bushels tomatoes,.....	.80	600.00	
925 bushels turnips, Rutabaga,.....	.75	693.75	
75 bushels turnips, purple top,.....	.75	56.25	
450 bunches thyme,.....	.02	9.00	14.257.75
			<hr/>
			\$29,639.68

FLORIST'S REPORT FOR THE FISCAL YEAR ENDING OCTOBER 31, 1916.

The following is a report of work done in the Florist's Division of the Warden's Department. This work includes growing flowers and plants for the decoration of the wards and other parts of the hospital as well as other work, such as the making and maintaining of flower beds and other allied work as directed by the managers:

PLANTS AND BULBS GROWN FOR FLOWER BEDS AND CUT FLOWERS.

Pansies.....	1,628
Geraniums.....	3,640
Forenia.....	246
Coleus.....	4,449
Celossia.....	18
Petunia.....	1,914
Salvia.....	2,412
Vinca.....	631
Helichrysum.....	500

Heliotrope	180
Chrysanthemums	4,727
Lobelia	46
Dahlia	833
Cannas	2,777
Alternanthera	295
Snapdragon	2,796
Sweet Peas	600 ft.
Asters	5,780
Balsam	500
Gladiolus	10,000
Roses	1,446
Carnations	1,595
Begonias	965
Cobala	32
Hanging Baskets	27
Verbena	584
Ageratum	966
Jerusalem Cherries	254
Ferns	98
Cyclamen	288
Hyacinths	227
Easter Lilies	260

RECORD OF CUT FLOWERS.

Roses	25,817
Carnations	5,634
Chrysanthemums	3,455
French Roman Hyacinths	4,205
Dahlias	24,290
Snapdragon	14,258
Gladiolus	6,431
Lilies	118
Asters	10,479
Strawflowers	1,604
Narcissus Paper White	1,663
Narcissus Double	1,108
Sprenger Strings	3,098
Peonies	252
Pansies	50
Phlox Hardy	9,717
Sweet Peas	1,800
Golden Glow (Rudebeckia)	2,775
Rambler Roses	865
Fern Leaves	1,300
Iris	1,900
Japanese Lilies	1,124





